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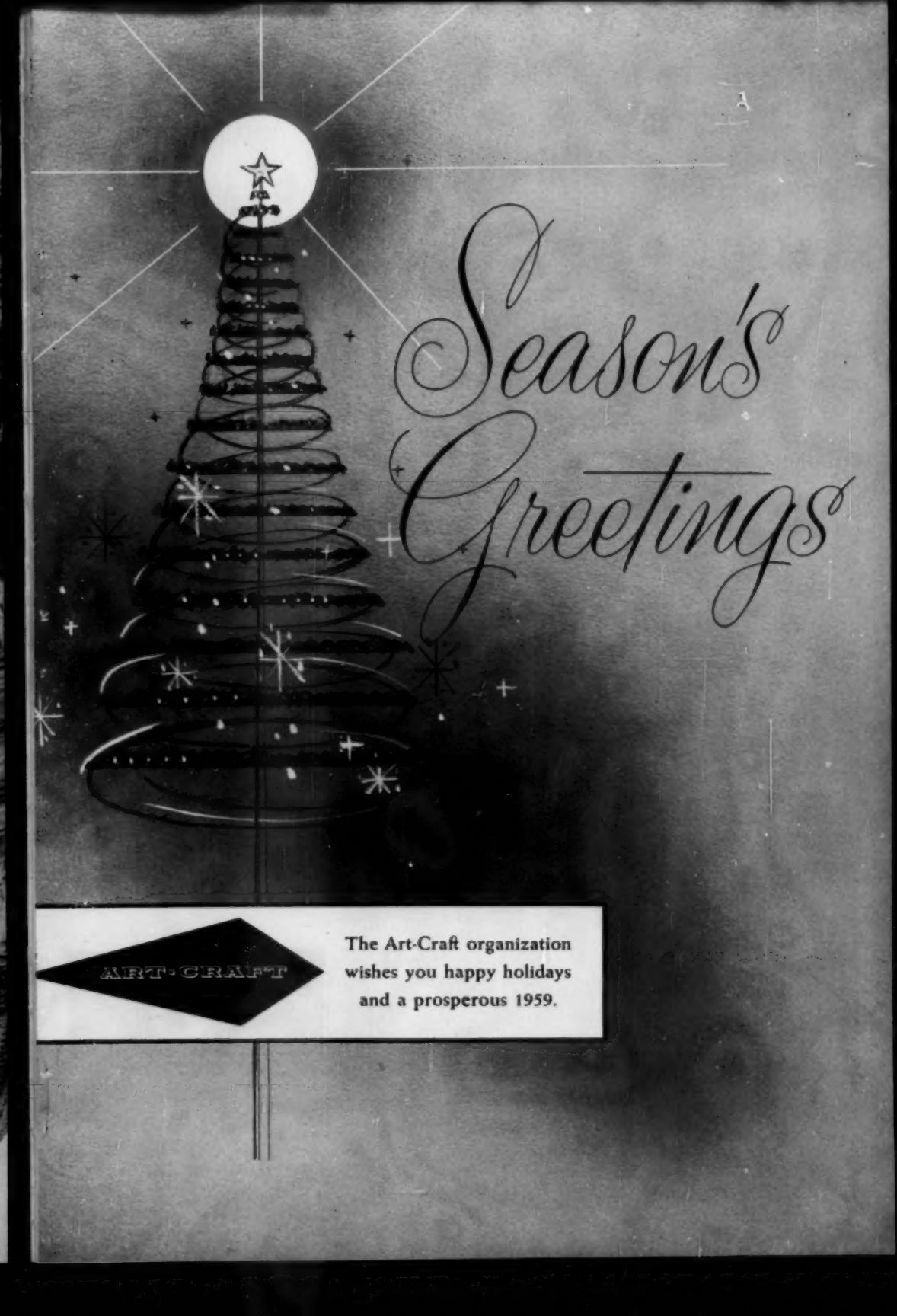
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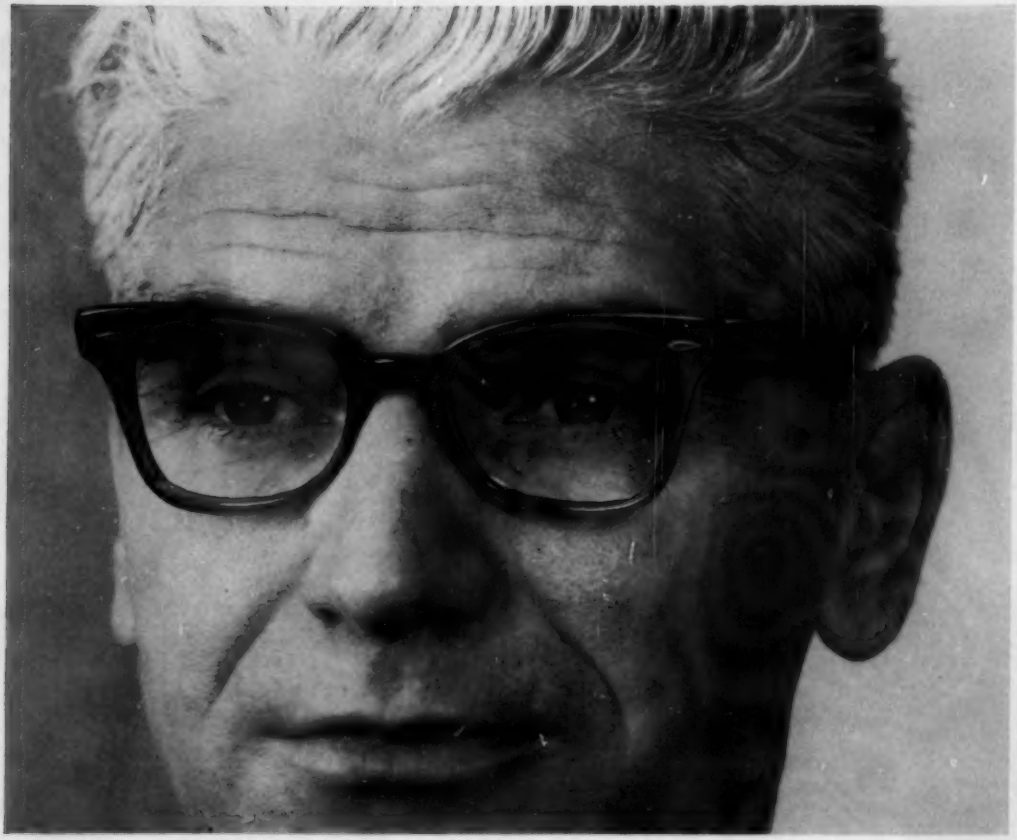

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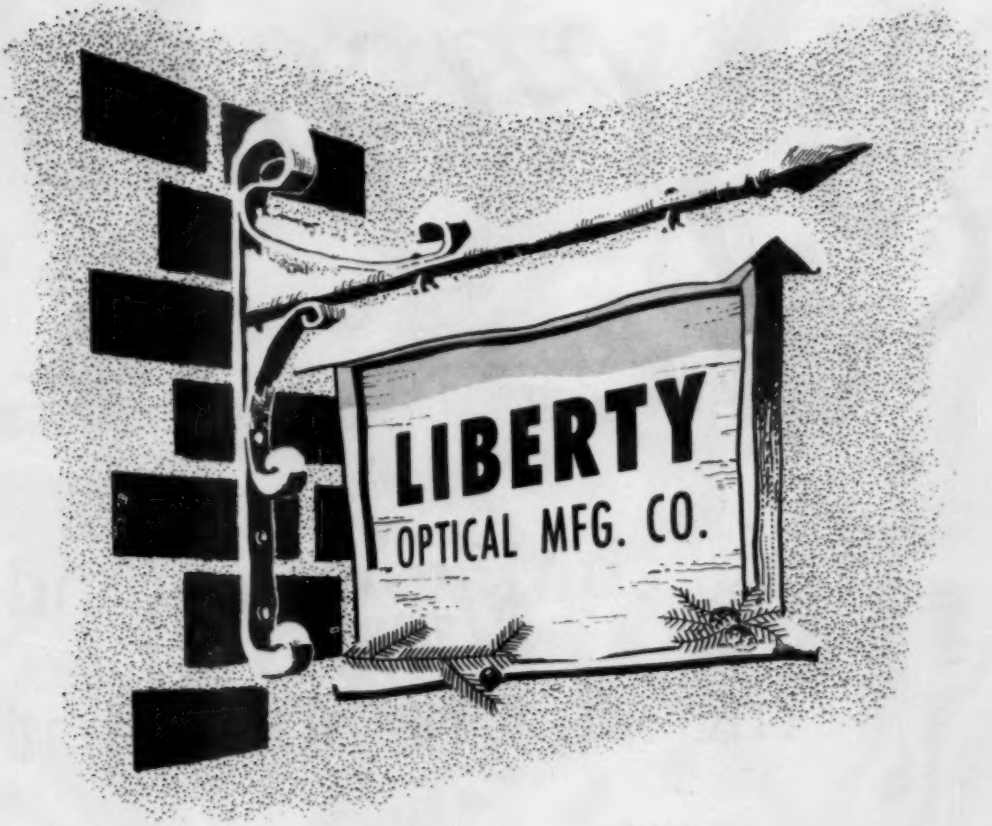

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Vol. 35 December, 1958 No. 12

BASIC PRINCIPLES OF CONTACT LENS FITTING*

Norman J. Weiss†
Tonawanda, New York

INTRODUCTION

The field of contact lenses is increasing in popularity. New developments reduce the initial irritation of the patient and make the lenses more acceptable and wearable for longer lengths of time. Unfortunately, with this increase in popularity, there has been a relative lack of experimentation and explanation of the various phenomena that have occurred previously and are occurring with the new developments. It will be the purpose of this paper to discuss some of these phenomena, their explanation—mathematical, physical, and physiological, and the results of some of the initial experimentation done by and on the author and several patients with respect to the more recent method of fitting using the principle of apical clearance.

DISCUSSION OF SOME OF THE BASIC PRINCIPLES

If one corner of a handkerchief is dipped in water and rolled within the rest of the handkerchief, after squeezing, it will be found that the water spread through the cloth. Similarly, an inkblot on the pages of a book will spread if the book is closed and pressure is exerted on the covers. The above are two examples of capillary action, which is one of the two theories that explain the adherence of the lens to the cornea.

In the examples above, each has three elements in common: a liquid, another substance in contact with the liquid, and external pressure. All three are necessary for the demonstration of capillarity. In the eye, these elements are the tear fluid, the contact lens, and atmospheric pressure as the external force.

Capillarity is best explained using the idea of intermolecular forces. This phenomenon results from the molecular attraction between the rear surface of the contact lens and the lacrimal fluid. The fact that the inside of the contact lens is wet upon removal indicates that the molecular force exerted by the layer of tear fluid on the posterior surface of the contact lens is greater than the force that holds

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†Optometrist.

the molecules of lacrimal fluid together. The former force is known as adhesion and the latter, as cohesion.

It is one of the properties of a droplet of moisture to assume the shape that has the least possible surface exposed. To do this, there is a certain force or pull needed. In the case of a droplet, the force would be exerted around its circumference. This force or pull is called the surface tension of the liquid, and is the second principle concerned with the association of the lens with the cornea.

Once the capillarity of the tears and contact lens has taken effect, due to the adhesive action of the lacrimal fluid in this process, the surface tension of the tear fluid will pull the lens, as it were, to the center of the "lacrimal droplet" and to the cornea.

A lens of short radius is said to be tighter than one of a longer radius, relative to the radius of the cornea. Indeed, this is true and is substantiated by the physical principle that the pressure produced by a spherical film is inversely proportional to the radius of the film. Experimentally it can be demonstrated with two bubbles of different size blown on similar funnels. If the funnels are joined by a rubber tube, the smaller bubble shrinks and forces air into the larger bubble. This principle applies not only to bubbles, but to droplets of moisture as well. The algebraic expression of this principle is:[1]

$$p = 2S/r$$

where p = the hydrostatic pressure of the film or droplet, S = the surface tension, and r = the radius of the film or droplet.

As the radius of the rear surface of the contact lens is reduced, the anterior radius of the droplet or "lacrimal lens" is simlarly decreased and the curvature is made steeper. By the principles of the pressure produced by a spherical film as stated above and that of surface tension, it would follow that a lens of relatively steeper curvature than the cornea would be pulled more toward the cornea than one of flatter curvature. Hence the lens of steeper curvature is tighter.

Although contact lenses reduce the magnification of the retinal image, some magnification (or minification) remains.

The total magnification of a correction lens is a multiple of the power magnification and the shape magnification. The spectacle magnification accounts for that due to the power and fitting distance of the lens and is expressed by:

$$1/1 - kF$$

where k = the fitting distance and F = the power of the lens. From this relationship it can be seen that as the fitting distance approaches zero, the spectacle magnification approaches zero.

The shape magnification accounts for the magnification of the lens as a telescope, since a lens of no refracting power will have magnification power by virtue of the front and rear curves and the optical thickness of the lens. This is expressed by

$$1/1 - cF_1$$

where c = the optical thickness of the lens (the center thickness divided by the index of refraction) and F_1 = the refracting power of the first surface. The entire exact expression then, for the total magnification power is

$$1/1 - cF_1 \times (1/1 - kF)$$

Since the lens under consideration can be termed infinitely thin, the refracting power (F) of these lenses is approximately the same as the vertex power (V). In the expansion and simplification of the expression below, this substitution has been made.

$$\text{Magnification} = cF_1 + kV$$

To express the magnification in per cent, the units of the optical thickness (c) must be in centimeters; refracting power of the first surface (F_1) in diopters; the fitting distance (k) in centimeters; and the vertex power (V) in diopters.

Since the fitting distance of contact lenses is so small, the term kV can be disregarded and the magnification becomes considerably less than with spectacle lenses. The optical thickness of a contact lens is small, but large enough to make a slight contribution to the magnification of the retinal image.

In cases of post monocular cataract surgery, where both eyes were emmetropic before surgery, the application of the magnification relationship will help determine the necessity of prescribing contact lenses monocularly or binocularly, since, for example, a monocular magnification of 3% is significant but a binocular magnification of 3% is not.

DIFFERENCES BETWEEN THE TWO TYPES OF CORNEAL CONTACT LENSES

Upon initial and cursory examination of a micro-lens and a lens fitted using the principle of apical clearance, no apparent difference will be found. Assuming that both the lenses under consideration were prescribed for the same eye of one patient, the following differences will be found on a more exacting examination.

1. The inside radius of the apical clearance lens is much shorter than that of the micro-lens.

2. There will be a bevel on the periphery of the inside curve of the newer lens, representing a reduction of curvature in this area.

This will be approximately one millimeter in width. The micro-lens will not have this pronounced bevel.

3. The refractive power of the lenses will be different due to the differences in rear curvature.

The question now raised is why are these changes necessary for an apparent increase in comfort? An attempt is now being made to conform more to the contour of the cornea, considering its peripheral reduction in curvature.[2] Beveling or relatively flattening the lens peripherally is introduced to conform better to the periphery of the cornea. The bevel and the closer approximation of the central part of the lens to the curvature of the cornea result in less contact of the lens with the cornea and probably in a more efficient lacrimal circulation. As yet, however, I have no experimental data to substantiate this physiological implication.

METHOD OF FITTING THE CONTACT LENS OF STEEPER CURVATURE

Another difference between the contact lenses is apparent when both lenses are viewed with fluorescein under ultra violet light. The micro-lens will have a central portion of touch between the cornea and the rear surface of the lens. The lens which is with apical clearance fit where the curvature more closely approximates that of the central cornea, will have a central pool of fluorescein, surrounded by a ring of corneal touch which in turn is surrounded by a darker rim of fluorescein. Figure 1.

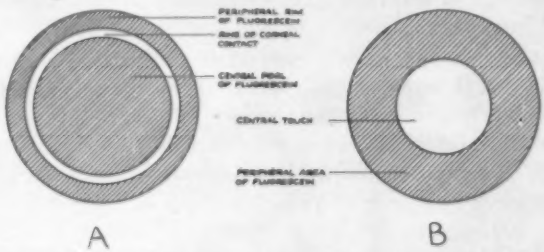

Fig. 1. Comparative drawings of the normal fluorescein patterns using the apical clearance technique (A) and the micro-lens technique (B).

Simply finding a lens that shows the fluorescein pattern described above is not satisfactory for a good fit. A lens that is too steep may show a fine pattern, but may produce many subjective symptoms. These symptoms will be discussed in a following section.

It has been my experience that prescribing directly from the ophthalmometer finding is not sufficient. To arrive at the proper curvature, the optometrist must be able to read the fluorescein patterns.

The procedure I use, and the one I find most effective, is this. To find the working radius of the cornea, that is, one which will be used to estimate the radius of the back surface of the contact lens, use the mean of both principle meridian readings. To help simplify the interpretation of this power into radius, I have presented in Table 1 the radii and the powers of the first surface of the cornea. Table 2 represents the relative position of these corneal radii on a dioptric scale of the anterior corneal refractive power. Some laboratories will work with dioptral powers rather than radii. If this is the case, some of the conversions used may not be necessary.

The mean ophthalmometer reading is used as a starting point whether the case is one of slight or marked degree of astigmatism. Its corresponding radius by no means represents the curvature of the final lens. The curvature of lens first inserted is that which is not more than 0.10 mm. shorter than the radius derived from the ophthalmometer readings. For instance, if the mean of the ophthalmometer reading was 44.00 D., I would be inclined to first observe the fluorescein pattern as shown with a lens of back radius of 7.6 mm. (See Table 2.)

If the fluorescein pattern was satisfactory with this lens, it would be necessary to observe the pattern with a lens of radius 7.7 mm. Even though this lens should theoretically show some portion of central

TABLE 1.

The radii of curvature of the first surface of the cornea (r_{e_1}) and the corresponding refractive powers (F_{e_1}). The radii are expressed in millimeters and the refractive powers in diopters. The corneal index for this computation is 1.3375.

(mms.) r_{e_1}	(Diopters) F_{e_1}	(mms.) r_{e_1}	(Diopters) F_{e_1}
9.6	35.15	7.7	43.83
9.5	35.53	7.6	44.40
9.4	35.90	7.5	45.00
9.3	36.29	7.4	45.60
9.2	36.68	7.3	46.23
9.1	37.08	7.2	46.87
9.0	37.50	7.1	47.53
8.9	37.92	7.0	48.21
8.8	38.35	6.9	48.91
8.7	38.79	6.8	49.63
8.6	39.24	6.7	50.37
8.5	39.70	6.6	51.13
8.4	40.17	6.5	51.92
8.3	40.66	6.4	52.73
8.2	41.14	6.3	53.57
8.1	41.67	6.2	54.43
8.0	42.18	6.1	55.32
7.9	42.72	6.0	56.25
7.8	43.27		

F_{c_1}	r_{c_1}	F_{c_1}	r_{c_1}	F_{c_1}	r_{c_1}	F_{c_1}	r_{c_1}
35.00	9.6	41.00	8.2	47.00		53.00	
—	9.5	—	8.1	—	7.1	—	6.9
—	9.4	—		—		—	
36.00	9.3	42.00	8.0	48.00	7.0	54.00	
—	9.2	—		—		—	6.2
—	9.1	—	7.9	—		—	
—		—		49.00	6.9	55.00	
37.00	9.1	43.00	7.8	—		—	6.1
—	9.0	—		—	6.8	—	
—		—	7.7	—		—	
38.00	8.9	44.00		50.00		56.00	6.0
—	8.8	—	7.6	—	6.7	—	
—		—		—		—	
—	8.7	—		—		57.00	
39.00		45.00	7.5	51.00	6.6		
—	8.6	—		—			
—	8.5	—	7.4	—			
—		—		52.00	6.5		
40.00	8.4	46.00		—			
—		—	7.3	—	6.4		
—	8.3	—		—			
—		—		53.00			
41.00	8.2	47.00	7.2	—			
—		—		—	6.3		
—	8.1	—	7.1	—			
—		48.00		54.00			
42.00							

TABLE 2.

The relative position of the corneal radii on a dioptric scale of the anterior corneal refractive power. The radii (r_{c_1}) are expressed in millimeters and the refractive powers (F_{c_1}) are expressed in diopters.

touch. I have found many cases where it is possible, and necessary, to fit much flatter than the theoretical expected due to objective findings of the fluorescein pattern. This may be the case especially in high astigmats and with those patients whose peripheral flattening of the cornea is a little steeper than what is ordinarily expected.

In summary then, with the ophthalmometer as an approximation, I am trying to find that radius of lens which, when increased by 0.10 mm., will show a central touch.

The radius and resulting minimal pool is not all that is required for a satisfactory fit. The diameter of the lens is an important factor and should first be estimated from the measurement of the corneal and pupillary diameters. Although the horizontal and vertical measurement of the cornea is not exactly the same, I have found there is little error induced by using the horizontal meridian only.

The diameter of lens to be prescribed should be that which shows a 1 mm. to 1½ mm. difference between the superior edge of the lens and the superior limbus. To observe this difference, spread the upper and lower eyelids of the patient and allow the lens to slide down the

cornea until it reaches the lower limbus. If the lens is too large, there will be little or no movement which will inhibit the necessary circulation of lacrimal fluid and oxygen. If the lens is too small, it will slide down and intersect the superior pupillary margin.

In reducing the diameter of the contact lens, always be cognizant of the pupillary diameter. Some[3] practitioners have suggested that the diameter of the lens should be reduced to 8.5 mm., and less in some cases. The assumption here is that the lens will stay on the apex of the cornea and not move. But I have found that there is movement—due to movement of the lids and to the pull of gravity. This lens movement causes a subjective, ticklish sensation which causes the patient to blink—and the cycle to start all over again. When the patient doesn't blink, gravity will pull the lens down until it meets an opposing force at the limbus, and doesn't slide any further. The patient now is probably viewing through the edge and/or bevel of the lens. This will evoke specific subjective reactions and will be discussed in another section of this paper.

No mention is made of the influence of the palpebral fissure in determining the diameter of lens. It has been the author's experience that, in general, small palpebral fissures usually are accompanied by small corneas; large palpebral fissures, by large corneas. In a few of the cases of large corneas and small palpebral fissures, the author has found that a reduction in lens diameter may cause some additional comfort. However, in these cases, differentiation must be made between a small, physical palpebral fissure and a wincing appearance caused, possibly, by a tense and reluctant individual.

No measurements were taken for a quantitative differentiation between palpebral fissure size. In the primary position, the sizes were differentiated on this basis:

1. A normal palpebral fissure is one where the upper lid is tangent to or slightly intersecting the superior limbus.
2. A large palpebral fissure is one where the upper and lower lids are not in contact with the cornea or limbus.
3. A small palpebral fissure is one where the upper and lower lids intersect the superior and inferior limbus, respectively.

The approximate refractive correction of the contact lens is first determined from the spectacle prescription. For the purpose of contact lenses, the spectacle prescription is used in terms of its equivalent sphere. Some work has been done in incorporating a cylindrical correction into a corneal-type contact lens. However, this is only in an experimental stage and the results are not conclusive. In all cases where the spectacle

prescription is above ±5.00 D., always account for the lens effectivity.

Another factor to consider in arriving at the refractive correction of the contact lens is the curvature of lens used. For each 0.10 mm. variation in radius from the initial ophthalmometer finding, there will be a change in the refractive power. In the case discussed at the beginning of this section, assume that the 7.6 mm. radius lens was the one of best fit. This would then effectively increase the power of the cornea to approximately +44.50 D. from the ophthalmometer finding of +44.00 D. Using thin lens optics, the cornea, with a contact lens in place, can be effectively disregarded because of the similarity between the refractive index of the lacrimal fluid and the cornea (index of lacrimal fluid = 4/3; index of the cornea = 1.337). Accordingly then, the power of the contact lens prescription must be increased by —0.50 D. to account for this difference.

Never try to arrive at the first refractive finding until the initial subjective reaction has subsided. The tearing will falsely influence the refractive finding. The refraction at this time should only be on a subjective monocular basis. Using spherical trial case lenses, alter the prescription in the contact lens so that it is the same as the adjusted spectacle prescription. If the acuity elicited is the same or better than the acuity through the spectacle prescription, determine whether the patient is accommodating through this prescription and change it accordingly.

If there is some difficulty in correcting the acuity of the patient to a comparable maximum spectacle acuity, consider: (1) excessive tearing; (2) a scratched or marred central portion of the contact lens; (3) a warped contact lens; (4) a grease smudge on the lens.

After the patient has become adapted to the lenses and is wearing them four to five hours each day, a complete refraction should be done. This period of adaptation may vary from three weeks to eight weeks, depending upon the individual.

Heretofore it has been implied that a trial case of contact lenses is desired and necessary. Indeed, this is the case. The most desirable assortment of lenses would be a set of three series: 10.0 mm., 10.5 mm., and 11.0 mm. in diameter. Within each series, the range of rear curve should vary in increments of 0.10 mm. from a radius of 6.9 mm. to 8.2 mm. However, I have found that working with one series of lenses of 10.7 mm. in diameter is sufficient. To incorporate the refractive power of lens as a variable would result in too many lenses. The refractive portion of each lens can be varied at the discretion of the optometrist.

LABORATORY METHODS

Terms such as bevel and reduction in diameter have been used

until now without sufficient explanation as to the laboratory procedures involved. These changes are important and while the method I use is relatively crude, the results obtained are good.

The main instrument necessary to make surface changes on the lens is a dental motor or lathe with an average speed of 3,000 to 7,500 r.p.m. It should be adapted to accept a Jacob's chuck which in turn will accept a tooled rod to hold the lens. This rod should be about 2½ inches in length and should be concave at one end. The motor can be purchased from a dental supply house and the rod will have to be tooled specifically for this purpose.

The lens is held in place by means of tape which adheres on both sides. It is centered on the rod so that there is no movement when the machine is turning. The bevel is made on the lens with a razor blade. With the machine in operation, the razor blade is held so that it is not parallel to the rear curve, but rather making an acute angle with it, as shown in the diagram. Figure 2.

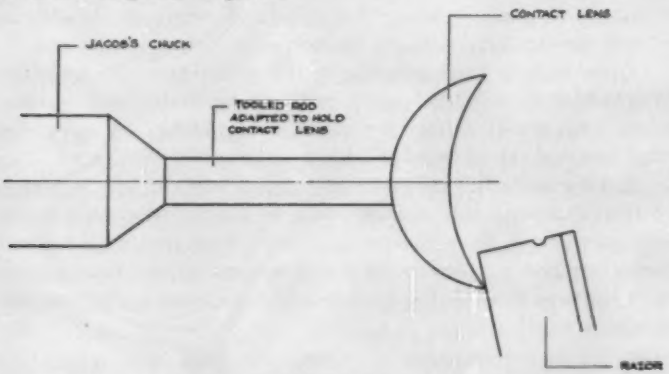

Fig. 2. Schematic drawing showing the angle of the razor edge in relations to the rear surface of the contact lens when beveling.

The razor is held at the same angle while being applied to the lens. As the razor cuts the lens, the width of the bevel will be increased and can be easily observed. The cuttings from the lens should be of a fluffy consistency. When the cuttings have become powderly, reverse or change the razor. Only through experience will the optometrist know exactly how steep and how wide to make the bevel. After the bevel has been completed, *lightly* round the edge of the lens with a fine file or dental sanding disc. The dental sanding disc is preferred as it is not as bulky as the file. If a file is used, it should be held at both ends and rocked from left to right. Figure 3.

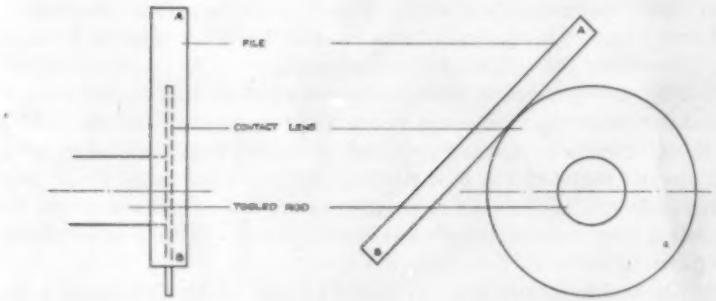

Fig. 3. Schematic drawing of the correct position of the file in relation to the contact lens in two views. The file should be held with one hand at A and the other at B.

To reduce the diameter of a lens, use the same procedure for finishing the edge of a lens as described above, except that a coarser sanding disc or file may be used. The type and degree of abrasive surface used will depend largely on the amount of reduction in diameter.

After each of these procedures, it will be necessary to polish the lens which is done with a paste made of tin oxide and water. It is applied with a soft dauber for about two minutes. Always keep the dauber wet and try to avoid touching the center of the lens.

It may seem that this method for beveling the lens is very crude. It is true, that with this method one never knows how much flatter the peripheral curve is from the central curve. But until a convenient and accurate method for determining and measuring the flattening of the cornea has been devised, the knowledge of the exact peripheral curve on the lens is worthless.

SYMPTOMS—EXPLANATION AND ALLEVIATION

When the patient is wearing the contact lenses for the first time, tearing should be expected. Some patients will not tear at all, while others will exhibit epiphora. To help keep the lid irritation and the awareness of the lens at a minimum, the optometrist should have the patient keep his head erect and look downward. Under these conditions, the normal tearing should considerably decrease in ten to fifteen minutes.

If there is no improvement at the end of this time, remove the lens and examine it. There may be a slight roughness on the edge of the lens, or a need for more polishing in the area where the lens was beveled. Another cause for this excessive tearing may be a sharp edge at the periphery of the lens caused by too steep a bevel. If this occurs, lightly round the edge of the lens by filing.

To help prevent the edge of the lens from becoming too thin after beveling, the original lens as returned from the laboratory should not be thin. In general, the central thickness should be approximately 0.2 mm. to 0.3 mm. Of course, a cataract lens and that of high hyperopes will be thicker. In these cases it may be necessary to order the lens slightly larger in diameter and then reduce it at the office. The edge thickness may otherwise be too thin.

If the lens shows none of the faults mentioned above, then rinse it well and reinsert it. Many times this will be all that is necessary: the cause of tearing was probably a piece of lint on the lens.

The symptoms of a sudden stinging, sharp pain accompanied by tearing, after the lenses have been worn for some time, are indicative of a speck of dust or soot under the contact lens. The symptom will be irregular and sudden in onset, and most of the time will occur when the patient is outdoors. It also may occur indoors due to a foreign body being dislodged from the eyebrows or the eyelashes. The duration of this symptom may be only a few minutes and then subside, or it may continue and apparently increase in severity. In the former case, the lacrimal fluid washed the foreign matter away.

Unfortunately, there is nothing that can be done, concerning an adjustment on the lens, to alleviate this situation. Some practitioners recommend reducing the diameter of the lens to increase the lacrimal circulation. The results in these cases are not conclusive and this change may cause other symptoms.

Patients should be told of this symptom. If it occurs, they can ease the situation by looking downward and allowing the lacrimal fluid to move the foreign body. If there is no relief in two to three minutes, the patient should remove the lens and reinsert it. If the lens is not removed after three minutes, there is a good possibility that the foreign body may cause some superficial corneal abrasion.

In most patients, one of the most noticeable and perhaps disturbing symptoms is that of finding quite a bit of difficulty in looking upward when the lens is first inserted. This is to be expected because of the greater contact the upper lid has with the cornea when looking in that direction. The patient should be told to expect this, perhaps even before the fitting has been started. The ability to look upward will greatly improve as the lenses are worn. But the ability to look up with the lenses will never be as good as without them. There will always be a small compensatory head movement.

Corneal staining indicates an abrasion. It may occur after the visit when the patient first wears the contact lenses, or after the lenses

have been worn some time and soot or dust under the lens rubs the cornea. If the abrasion is superficial, there may be no sensation of pain or reduction in acuity. Of course, the more central the abrasion, the more effect it will have on acuity. Deeper abrasions will cause considerably more discomfort and scleral injection. There may be some corneal swelling and reduction in acuity in these cases.

During the period that the patient comes to the office, it is important that the cornea be examined with fluorescein before, during, and after the visit for the detection of any abrasion. If one should occur, try to determine, and remove, the cause; keep the lenses off the eye; and watch the daily progress of the abrasion. The abrasion may cause some photophobia and it may be advisable to have the eye patched during the day. After 24 hours there should be an improvement. It is not unusual, in small superficial abrasions, for the corneal epithelium to regenerate in 24 hours. If, after 48 hours, there is no improvement, refer the case for a medical consultation.

Corneal epithelium will regenerate itself, leaving no scar; Bowman's membrane, directly posterior to the epithelium, will not. However, while there are a few cases of superficial staining, an abrasion involving Bowman's membrane due to contact lenses will almost never be seen. The subjective reaction will serve as a check on this.

It may occur that a patient will complain of a sudden decrease in visual acuity that apparently has taken place over night or within a period of two to three days. The blurred vision will be consistent, occurring each time the lenses are worn, and may become worse. Subjectively, there will be no improvement of acuity with the addition of plus or minus lenses. Examination of the rear curve of the lens with the ophthalmometer will show a difference in curvature between the vertical and horizontal meridians. The lens has been warped and is introducing a cylindrical effect. Nothing can be done to correct this situation except to re-order another lens.

The lenses will warp when exposed to excessive heat and dryness. Patients should be admonished to keep their lenses away from radiators, from sunlight and other sources of heat, when not in the eye. Keeping the lenses dry when not in use will have an effect on the plastic, too. The lenses should always be wet when returned to the case. Special soaking kits are available to keep the lenses moist when not in the eye. These are unnecessary and I find that putting the lenses away in the ordinary plastic case and filling each compartment with cool water is sufficient.

Slipping or excessive movement of the lens may be manifest as a

ticklish sensation causing the patient to blink. Accompanying this sensation and blinking, the patient may complain that his vision seems good after blinking, but gradually gets worse, until he blinks again.

Examine the lens in the eye and observe its position before blinking. If the periphery of the lens seems to intersect any part of the pupillary border, manipulate the lens with the lids so that it is situated centrally and the patient is not looking through the bevel. If there is an improvement in vision, then the symptoms are probably due to a lens that is too small in diameter.

To alleviate these symptoms, consider re-ordering a lens of larger diameter. These symptoms should not occur if conservative reductions are made on the diameter of the lens. If the symptoms occur even though the diameter is not too small objectively, allow and encourage the patient to wear the lenses for about one week. I have found that these sensations will subside the longer the lenses are worn.

Another annoying and sometimes frustrating occurrence is the falling out and displacing of the contact lens. If the fluorescein pattern appears to be good, yet the patient complains of the lens falling out, measure the center thickness of the lens. I have found that a lens with too great a central thickness will have more of a tendency to cause this.

The displacement of the lens may occur when the patient is practicing insertion. Many times he will blink before the capillary action has a chance to take effect fully and the force of the lid over the lens will be sufficient to displace it from the cornea. Displacement may also be due to extreme and quick movements of the eye. The velocity and extremity of the movement will act as an unbalanced force and will disrupt the equilibrium of forces that exists, from Newton's first law of motion. This certainly does not mean that extreme and quick movements are impossible. But until the patient can wear the lenses for any length of time and through experience learn how fast and extreme the ocular movements can be, they should be restricted and conservative.

After wearing the lenses for eight to ten hours, I have found that there may be a secretion formed in the eye. It is recommended that at this time the lenses be removed, rewashed, and reinserted. It may be noticed, too, that the lacrimal fluid remaining on the lens may appear to be turbid. This turbidity and secretion may account for the subjective appearance of a veil or fog. Careful differentiation must be made between this type of fog and the fog which is due to lack of nutrition to the cornea and associated with a lens that is too steep or too large in diameter.

Some patients will complain that they see ghost-like images, similar to those sometimes seen on television screens. The symptoms will be consistent, occurring each time the lens is inserted. They will be most apparent when the object is on a light background.

There is no satisfactory explanation for this phenomenon, but I have found that in such cases, the bevel of the lens has been very wide. On re-ordering the lens and reducing the bevel, the symptom was decreased. In these cases there was no way of knowing if the improvement was due to a flaw in the lens or the width of the bevel. However, under the assumption that the symptom was due to the width of the bevel, I increased the bevel on my own left lens and found these ghost-like images appeared intermittently. There remains quite a bit of work to be done before a definite conclusion can be reached.

A lens that shows a bubble centrally indicates that the curvature of the lens is too steep. If this occurs during the period where the trial lenses are being used, certainly observe the pattern with a flatter lens. If the next flatter lens is too flat, which is not apt to be the case, order the steeper lens. To reduce the bubble, the lens must be beveled and/or reduced in diameter, thereby increasing circulation and allowing more tear fluid into the central pool.

By a peripheral bubble, I mean one that will confine itself to the periphery of the lens. This type of bubble is due to a more sudden flattening of the peripheral cornea. Figure 4. It might be said to resemble an extremely mild form of keratoconus. In working with these cases, I have found that many of the subjective symptoms are markedly decreased if a lens of possibly 0.3 mm. or 0.4 mm. longer radius than theoretically expected is used. The fluorescein pattern should nevertheless indicate a normal fit.

The majority of patients complaining of radiations from lights will have particular reference to oncoming headlights of cars and to street lamps. The linear radiations may be colored or white, depending upon the light source, and they will seem to emanate from the center of the source. They are noticed more at night than during the day because the brighter daytime background will camouflage these radiations. During the day they will occur in dim enclosures, but will be most noticed at night. This symptom seems not to be a function of the wearing time. Not all patients will complain of this symptom and it will probably vary directly with the degree of discrimination of the individual.

The exact reason for this occurrence has not been determined. Some patients who have worn the micro-lens successfully have difficulty in adapting to the newer type of fit because of the radiations. The

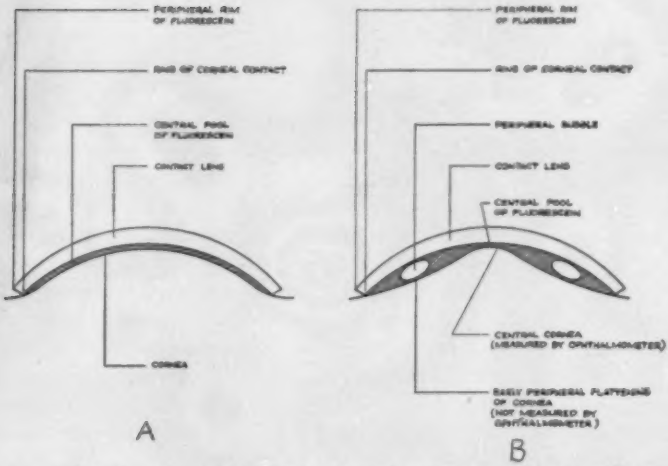

Fig. 4. Schematic cross sections of the normal apical clearance case (A) and the case where there is greater peripheral flattening of the cornea (B) causing a peripheral bubble.

reason, therefore, involves the central pool of lacrimal fluid which now exists rather than the central touch found with the micro-lens.

Colored concentric halos around lights is a subjective symptom of a tight lens. It is usually accompanied with the complaint of looking through fog or smoke.

If the lens causing these halos is of maximum radius, consider the following for the relief of the symptoms:

1. Increase the bevel of the lens for more circulation and a looser fit.

2. Decrease the diameter of the lens, but not to the extent where it intersects the pupillary rim of the iris. This is done for the same reason as above.

3. Re-check the ophthalmometer finding of the cornea and the back radius of the lens.

If there is any objective indication that the lens is too steep in curvature, such as a lack of sufficient movement or a central bubble, then one should check the rear curve of the lens and consider ordering another of longer radius.

Clear differentiation must be made between this symptom and that of radiations previously discussed. Both will be more apparent at night and in dim illumination, but most patients will help to differentiate between the two by describing, and perhaps drawing, their subjective symptoms.

The physiological interpretation of the halos and fogginess seems to stem from improper circulation. Fulton reports that interference with the oxygen supply of the cornea is followed by loss of transparency.[4] The halos seem to be similar to those found in cases of glaucoma. The pathological halos are explained by edema of the deeper layers of the corneal epithelium, caused either from droplets of fluid between the cells or from an alteration in refractivity of the cells swollen with fluid.[5] Although no quantitative work has been done on the amount of corneal swelling due to a tight contact lens, these corneal changes have been noticed during the examination of such cases. The physiological explanation is not complete, but again stems from improper circulation. Just as oxygen must be absorbed by the cornea, carbon dioxide must be allowed to diffuse away. If this is not allowed to happen, as may be the case with a tight lens, the cornea swells, the endothelium necroses and the whole tissue becomes opaque.[5] Another trend of thought involves the physiology of the tear fluid. The normal transparent cornea is markedly dehydrated and when placed in water, it swells to three or four times its normal thickness and becomes opaque. If the cornea now is placed in contact with a hypertonic solution, it loses water rapidly enough to remain dehydrated and transparent.[4] The small amount of water in the cornea is lost to the hypertonic tears, anteriorly. If the contact lens does not allow sufficient lacrimal circulation, the tear fluid beneath the lens may become hypotonic due to the concentration of water from the cornea, and result in swelling.

CONCLUSIONS

The advancement in contact lenses has relieved many of the subjective problems, but also has posed many others. Some of the problems have been presented in this paper, not all of which could be explained fully.

Relatively, then, the theoretical aspect of contact lenses is still in its infancy; practically, it has gone much further than this. Solving the unknown quantities will permit even faster development of the practical aspect.

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TONAWANDA, NEW YORK

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NEW READING MATERIAL FOR SUB-NORMAL VISION SUBJECTS*

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The author's work in the field of "reading-type" research, has been presented earlier.[1] The present report includes the evaluation of the print used, in relation to visual errors, and also the results of their use by subjects with uncorrectable sub-normal vision. Before giving these results, however, it is necessary to describe what was done at the same time to complete our knowledge of lower case letters and their formation into words. The relative visibilities of all the lower case letters had already been established both when viewed singly, and when viewed in groups. These were then related to three other sets of data: the area of each letter, the reflectance of each letter, and the frequency of occurrence of each letter in various kinds of publication.

FREQUENCY OF OCCURRENCE OF EACH LETTER IN PRINT

It seemed necessary to examine the possibility that the visibility of letters, or the readiness with which they are seen and recognized, may be related in some way to their familiarity, or the frequency with which they occur in reading. Counts were made on pages of precisely equal numbers of letters in journals of a dissimilar nature, one a popular magazine, and the other a journal using administrative language.

The results showed that there is obviously no true relationship between the actual visibility of a letter and the frequency with which it occurs in print. For instance, the letter "j" which is the most visible letter of the alphabet in most lower case tests with and without visual errors, has a frequency of appearance in print which is almost the lowest of all letters. On the other hand, the letter "a," while appearing many times in most sentences (exceeded only by "e" and "n") is almost always the lowest on the scale of visibilities. In fact, its recognition is undoubtedly influenced by its association with others letters around it which make up the words in which it appears.

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While there are a few letters which appear to have some relationship between frequency of appearance and order of visibility (r, c, l, u, m), these are too few to affect the assumption that no true relationship exists between the two groups.

THE AREAS OF LETTERS

The areas of all lower case letters were measured with a planimeter. Each letter was specially constructed with its body within a 4 × 4 centimeter square, the tails appending outside the squares. These letters were white on a black ground, so that by placing them on a large black background they could be completely isolated from adjacent reflections.

The black background was designed to enable these same letters to be used both for measurement of area and measurement of reflectance. The area of each letter was then measured carefully with a planimeter, and the resulting order of letters was compared with the orders found on the basis of actual visibility, both of single letters and of letters in groups.

Six letters have a very close relationship between the order of visibility and the order of area. These are a, c, e, k, n and s. But j, l, m, o, r, t and u are reasonably close in their order, and this gives a total of 13 out of 23 letters examined, or 54%. The letters w, x and z were not included in this test as they had been omitted from the visibility experiments because they had been measured among upper case letters in which their shapes are quite identical with lower case.

Although one can assume from the data found that letter visibility may be related to letter area, unknown psychological factors quite obviously play an important part in recognition. These may be partly or wholly involved with the word in which a letter actually appears. For instance, the letter "a" may have a better visibility score in the word "man" than in "lam" which is much less familiar. Here we are reminded of the earlier test in which the word "rape" was much more easily recognized than "pare," "pear," or "reap."

LETTER REFLECTANCE

These same letters were next placed individually in a preset position beneath a fixed photo-electric cell connected to a microameter. Readings of the amount of light reflected were taken for each letter in all four primary positions, upright, upside down, turned to the left, and turned to the right. These four readings were then averaged. The reason for using four positions was to offset any influence on the reading that might be exerted by a "tail" being in one certain direction and the illumination not being perfectly centered. This way, the "tail" was measured in four positions and the average from these should be the

most accurate measurement possible. These average readings were used to compile a table of relative reflectances, and this was then compared with the tables of visibility, area, and frequency of appearance in print.

As has already been stated, there appears to be no relation between the frequency of appearance in print and the visibility of letters. Nor is there any relation between this and area or reflectance. However, it was revealed in a table of the following five factors, area, reflectance, frequency of occurrence, visibility in groups, and visibility singly, that 32% of the letters were very closely related, while 65% were reasonably close in all the factors except frequency of appearance in print.

When the same relationships were tested with the letter visibilities conditioned by induced refractive errors, it was obvious that astigmatism or blur can be responsible for much changing of letter relationships. Even then 53% of all letters show a relationship between area and visibility.

INTER-LETTER SPACING

Last year the writer presented[1] two special paragraphs of print with different spacing, used in the 1956 experiments to ascertain the best method of presenting print to obtain maximum legibility. The findings were that 2′ arc spaces between letters which subtend either 5′ × 5′ or 5′ × 4′ arc improved word legibility over those with 1′ arc spaces as much as 120% for some subjects.

A further experiment showed that this ratio can be accepted with ametropic and astigmatic errors as well, some variability being encountered with different axes of astigmatism. The suggestion made in that report, that on the basis of these findings, improved print and spacing when of an adequate size should theoretically enable a subject with 20/200 visual acuity to read comfortably, has now been put to the test.

SUBJECTS WITH 1.50 D. MYOPIC ASTIGMATISM

When two forms of print were compared for legibility with various axes of astigmatism it was found that in a few instances only could the print be read with the axis of error at 90° when the inter-letter spaces were 1′ arc wide. But it could be read when the inter-letter spaces were 2′ arc wide. At axis 180°, most subjects could read 1′ arc spaced print, and all could read it easily when the spaces were 2′ arc. This is illustrated in a table of actual reading times wherein it can be seen that 1′ arc spaced print with a 90° error required the longest reading time, while 2′ arc spaced print with a 180° error required the shortest time. Figure 1.

1′arc with axis 90°	average reading time equals 100 %
1′ arc with axis 180°	average reading time equals 89.6%

2′ arc with axis 90° average reading time equals 80.1%
2′ arc with axis 180° average reading time equals 66.9%

The reduction of reading time by changing the print space to 2′ arc for an error at axis 180° is approximately 24%, and for both axes at least 20%.

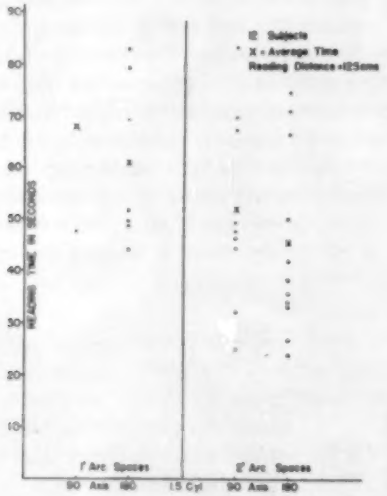


Fig. 1. It will be seen that with inter-letter spaces subtending 1′ arc, and the axis of astigmatism at 90°, only two of the twelve subjects (16.6%) were able to read, whereas at axis 180° seven of them (58.3%) completed the test. When the spacing was increased to 2′ arc, not only were all the reading times improved, but when the axis of error was 90° nine of the subjects (75%) qualified, and when it was 180° eleven (91.6%) of them completed it. The graph shows that when the axis of error is 90°, there is a 23.5% improvement in reading speed as the spaces are increased, and when the axis is 180°, the improvement is 25.4%.

SUBJECTS WITH SUB-NORMAL VISION

The use of induced visual errors obviously cannot wholly emulate a true sub-normal condition, so no actual claims can be made in favor of the use of this print for sub-normal vision subjects unless they are included in the experiments. In addition to the prints already used, two new pieces were devised which used almost the same words, but in different orders, and with somewhat different meanings to the resulting sentences. These had identically the same numbers of words, but were given the different 1′ arc and 2′ arc spacings. Figure 2.

The data resulting from the several tests revealed that in a number of subjects having best visual acuity of from 20/100 to 10/200, the reading times for words with inter-letter spaces of 1′ arc averaged 1.6 seconds per word, while those with 2′ arc inter-letter spacing aver-

SUB-NORMAL VISION TEST

Give me five lilies. I live like a king. The desert is only sand. Bill's brother bought a bank. Take your time with this. The water flows slowly. The shadow under the bridge.

Lilian's fine wedding ring. Five kings live there. The sands are deserted. My brother's bills are at a bank. This will take your time. The slow flowing water. The bridge casts a shadow.

Fig. 2. The print used for the test on which the graph in Fig. 3 is based. There are the same number of words in each paragraph, but the inter-letter spacing is 1′ arc in the first one, and 2′ arc in the second.

aged 1.3 seconds per word. In addition, there were subjects who could read the print with 2′ arc inter-letter spacing, but who were quite unable to read that with space of 1′ arc, so these had to be omitted from the results. Some of the subjects had almost equal difficulty with both prints, but literacy was involved in this. Figure 3.

The average differences in times of reading suggest that the larger spaces between the letters enable a given amount of print to be read in 20% less time than the same amount of print with the smaller spaces, when the latter could be read at all. This degree of improvement in performance is too significant to be ignored. All subjects capable of making a reliable personal observation were unanimous in their preference for the wider-spaced plain type offered in the tests. Figure 4.

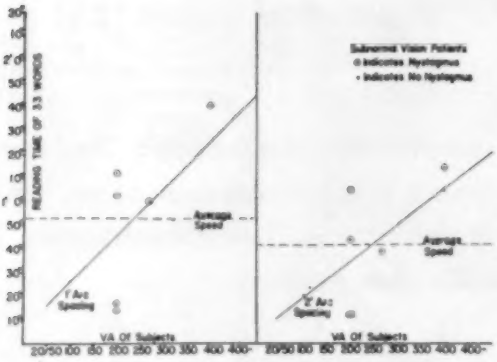

READING TIME OF 33 WORDS
Subnormal Vision Patients
o Indicates Nystagmus
• Indicates No Nystagmus
Average Speed
1' Arc Spacing
VA Of Subjects
20/50 60 80 100 150 200 250 300 350 400 400-
Average Speed
2' Arc Spacing
VA Of Subjects
20/50 60 80 100 150 200 250 300 350 400 400-

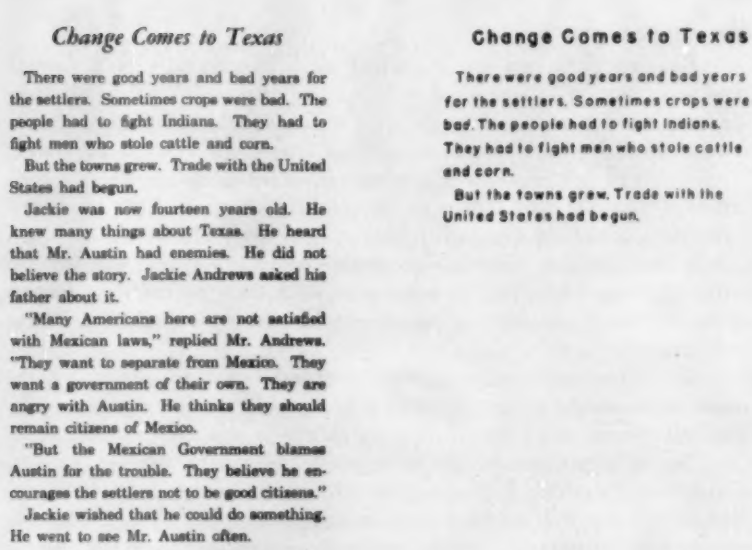
Fig. 3. This graph made on nine sub-normal vision subjects whose corrected visual acuities ranged from 20/100 to 10/200, shows that there is 19.4% improvement in reading speed with 2′ arc inter-letter spaces over 1′ arc spaces even though five of the subjects had nystagmus. One subject with 10/200 vision was quite unable to read print with 1′ arc inter-letter spacing even when the bodies of the letters were 2.5 mm. high. But this same subject made good time (73.5 seconds) when the spaces were 2′ arc.

Further tests in collaboration with the "American Printing House for the Blind" to examine the suitability of such a form of printing for the books they compile, is producing evidence that it is far superior to any kind of special printing already in use for people with sub-normal vision. It is intended to pursue the problem further in this direction.

BACKGROUND CONTRAST

During the course of work with the sub-normal vision patients at the Ohio State School for the Blind, some copies of the specially printed hand charts were made up with backgrounds of various density grey. There was no actual plan to this, only an idea that it might reveal something of interest. After each test, two charts of different backgrounds were offered to each subject to ascertain if background had any influence on legibility for them. But although there were definite preferences involved, the pathology of the subjects was so varied that no reliable figures could be compiled that would relate ocular condition with background preference.

A few comments may, however, be of interest. There were three high myopes, and these unanimously preferred backgrounds of low contrast. Altogether 60% preferred the dark background with the 1′ arc spaced print, 40% with the large space print, 38% preferred the light background with the small spaces, and 62% the light background with the larger spaces. 20% preferred dark backgrounds for everything, and 24% preferred light backgrounds for everything, the



Change Comes to Texas

There were good years and bad years for the settlers. Sometimes crops were bad. The people had to fight Indians. They had to fight men who stole cattle and corn.

But the towns grew. Trade with the United States had begun.

Jackie was now fourteen years old. He knew many things about Texas. He heard that Mr. Austin had enemies. He did not believe the story. Jackie Andrews asked his father about it.

"Many Americans here are not satisfied with Mexican laws," replied Mr. Andrews. "They want to separate from Mexico. They want a government of their own. They are angry with Austin. He thinks they should remain citizens of Mexico.

"But the Mexican Government blames Austin for the trouble. They believe he encourages the settlers not to be good citizens."

Jackie wished that he could do something. He went to see Mr. Austin often.

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Change Comes to Texas

There were good years and bad years for the settlers. Sometimes crops were bad. The people had to fight Indians. They had to fight men who stole cattle and corn.

But the towns grew. Trade with the United States had begun.

Fig. 4. On the left is print in 24 point type which is used by The American Printing House for the Blind. On the right is print similar to Gils sans serif in 20 point type which although slightly smaller is much more legible because it has 2′ arc inter-letter spacing as well as non-serifed design. A slightly larger space between the words would provide an even greater improvement in legibility. If the print on the right had been made with a printing machine instead of by hand, it would have been cleaner and even more legible. (Print reduced for illustration.)

remainder preferring light for some spacings and dark for others.

This naturally conflicts with established theories, and so it was decided to test a representative group of about fifty emmetropic subjects on this particular kind of print with backgrounds of three contrasts. The charts were equally illuminated and fixed at the same distance from the subjects' eyes at the beginning of each test, and gradually approached mechanically toward the eyes until they were seen, the distance being recorded at the point where reading became possible.

The results of this test series conformed to established theories, but with one interesting feature. While the background with greatest contrast (lightest) produced the greatest legibility for these subjects, in both widely and closely spaced prints, the difference was much greater in the latter than in the former. In fact the 2′ arc spaced print will accept a phenomenal reduction in background contrast with very little reduction in visibility. This at once suggests that the widely spaced print will have great advantages on poor paper.

CONCLUSIONS

Reading test types are at present made haphazardly, and various type faces of similar size have different visibility levels. Few of them are adequate for use on subjects with uncorrectable low vision. But a few additional criteria for making these charts can now be suggested.

1. The first requisite is not only standard sizes, but also a standard type face. If this is not to be specially designed, Gils sans serif (medium) meets the demands formulated by all visibility tests. When this is not available there are acceptable alternatives, the variation in visibility being negligible. Spartan semi-bold, Spartan medium, Futura medium, Monsen medium gothic, Bernhard gothic medium, and Vogue bold line.

2. The second requisite if sub-normal vision subjects are to be tested on standard reading charts, is an inter-letter spacing of exactly one-half the width of the letter 'o' in each type size.

3. The method of notation most commonly used in reading charts, i.e., Jaeger 1, 2, 3, etc., can still be retained even if Gils sans serif type face and 2′ arc inter-letter spacing is adopted. The Lebensohn or any other chart can also be adapted to these suggestions. But to offset the improvement in word visibility which cannot be extended to ordinary everyday print such as newspapers and telephone directories, a smaller type face such as might be called Jaeger 0 or Lebensohn's 20/13 would need to be included. And of course some larger print would be necessary also for recording levels of so-called sub-normal vision.

4. The ideal plan is to relate a standardized type face to the point system, and if Gils sans serif is used, this is already accomplished. Then all the letters in a word should be spaced one-half of the width of the letter "o" apart. This would produce the greatest possible legibility, and a wide range of acuities or values could then be accommodated on a standard chart.

The next task is to produce a clinically applicable reading test chart incorporating these criteria which can be related to special print for sub-normal vision subjects, and which can be used in printing the special books produced for these subjects by The American Printing House for the Blind.

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CONFIGURATION AND ORIENTATION OF TEST PATTERNS USED WITH THE HOMOKONIC CROSS CYLINDER FOR THE MEASUREMENT OF ASTIGMATISM*

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In the testing of astigmatism by means of a testing cross cylinder one deals with three toric wave fronts. The first is produced by the astigmatism of the eye, the second by the correcting minus cylinders in the refractor and the third by the testing cross cylinder. Optometrists attempt to compensate optically the toric wave front produced by the astigmatic eye by means of the correcting minus cylinders. The degree of this compensation is checked by presenting a toric wave front produced by a cross cylinder whose axis can be presented first at one position and then at a second position which is 90° from the first. This is accomplished by the flipping of the cross cylinder. When the correcting cylinder completely compensates for the astigmatism of the eye, then the two positions of the testing cross cylinder should produce equal amounts of blurredness** and the two test stimuli should appear equal in clarity.

This report is designed to show how the optical stimulus pattern produced by the Jackson cross cylinder and the test pattern can be analyzed mathematically into specific optical phenomena. From this analysis one can proceed to design systems which will eliminate or exaggerate these various phenomena and ascertain the importance of these various factors.

Figure 1 shows a compound meridional magnifier such as the Jackson cross cylinder mounted before the left eye with the optic axis passing through the center of the entrance pupil and intersecting the target plane perpendicularly at the point $\bar{P}$. The minor axis is positioned

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**Subjective refracting techniques employ equality or inequality of blurredness between two test stimuli which are psychophysical judgments. Thus, a given target configuration may be presented at two different orientations but with the same degree of out-of-focusness. They may appear of different blurredness on a psychophysical basis but be of equal blurredness on a dioptric out-of-focus basis. There should be a one to one relationship between the two, if the test is valid.

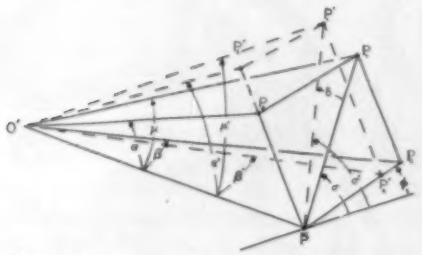

Fig. 1.

at the angle ϕ and coincides with the plane $O'\overline{P}PP_2$. The major axis is positioned at the angle $(\phi + 90)$. The four object points $\overline{P}$, P_1, P_2 and P_3 form a rectangle in a plane perpendicular to the optic axis. The images formed by the lens are not points since the lens produces astigmatic images. The lines $O'P_1$, $O'P'_2$, $O'P'_3$, and $O'P'$ represent the chief rays converging toward the entrance pupil and projected backward to the plane of the object. The points $\overline{P'}$, P'_1, P'_2 and P'_3 form a rectangle whose sides are parallel and perpendicular to the minor axis meridian.

Through mathematical analysis of Figure 1 it has been shown that the optical characteristics of the Jackson cross cylinder can be specified by the following three functions:[1]

(1) Differential meridional magnification, m, is expressed by the function:

$$m = a \sin^2 (\sigma - \phi) + b \cos^2 (\sigma - \phi)$$

(2) Differential rotary deviation is expressed by the function:

$$\text{Tan } \epsilon = \frac{(A - B) \text{ Tan } (\sigma - \phi)}{B + A \text{ Tan}^2 (\sigma - \phi)}$$

(3) Cross cylinder power is expressed by the function:

$$F\sigma = F_{(\phi + 90)} \sin^2 (\sigma - \phi) + F\phi \cos^2 (\sigma - \phi)$$

In the clinical testing of astigmatism with the cross cylinder one often uses targets which have a predominance of vertical and horizontal lines.[2] Statistically, there is a high probability that the axis of the astigmatism will be near 90° or 180°. The typical test pattern stimulus results in a maximum differential rotary deviation effect when testing for the axis of astigmatism and minimal differential rotary deviation when testing for power. On the other hand one will have a maximum differential magnification effect when testing for power and a minimal differential magnification effect when testing for axis.

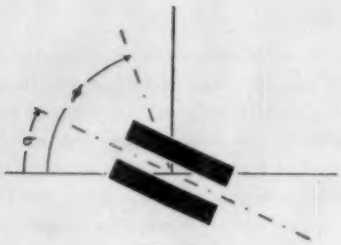

Fig. 2.

One can eliminate the differential meridional magnification effects and the differential rotary deviation effects by employing a Homokonic cross cylinder[1] which is essentially a bitoric lens with the cross cylinder power function and equiradial magnification.

The only remaining optical problem is the interrelationship between the orientation of the legs of the test pattern and the cross cylinder power function. By changing the angle of meridional orientation σ of a rectangular bar pattern with respect to the axis ϕ and $(\phi + 90)$ of the cross cylinder one can analyze the above optical problem by means of simple blur circle theory (see Figure 2). Different segments of the interval of Sturm have to be considered because of the variations in fog during the clinical tests. (See Figures 3 and 4.)

The focal line effects on the width of the retinal image of a rectangular bar produced by a ± 0.50 D. cross cylinder in an emmetrope under -0.50 D. fog can be mathematically analyzed as follows. If the minus axis is set at ϕ and the rectangular bar is rotated from $\sigma = \phi$ to $\sigma = (\phi + 180)$ one will note that the retinal image will have its minimum width at $\sigma = \phi$ and $\sigma = (\phi + 180)$ and its maximum

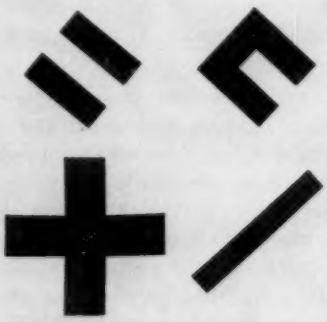

Fig. 3 (Top). Fig. 4 (Bottom).

width at $\sigma = (\phi + 90)$.

Thus, if one were to position the rectangular bar at $\sigma = \phi$ as is illustrated in Figure 3 and flip the cross cylinder through 90° the width of the retinal image could change from a minimum value to a maximum value. This is illustrated by considering the images formed by the posterior focal lines by the toric wave front in Figure 3. Now this emmetropic patient would interpret position ϕ of the cross cylinder as the clearest and the clinician would interpret this as astigmatism with axis ϕ.

Now orient the rectangular bar test pattern so that $(\sigma - \phi) = 45°$ (see Figure 4). As the cross cylinder is flipped from ϕ to $(\phi + 90)$ degrees there will be no change in the width of the retinal image of the rectangular bar test pattern. This will also hold if the rectangular bar test patterr. is orientated so that $(\sigma - \phi) = 135°$. If this same analysis is carried out for different magnitudes of fog, so that the retina will intersect different sections of the interval of Sturm it will be found that if the bar test pattern is set either 45° or 135° from the axis of the cross cylinder, then there will be no change in the width of the retinal image produced by the cross cylinder power function in the emmetropic eye. Under this testing condition the states of accommodation or fog will have no deleterious effect on the judgment between the presentation of the stimuli. The particular problem is minimized when the retina coincides with the circle of least confusion of the astigmatic bundle. Figure 4 shows the optical pattern produced when the retina coincides with the anterior focal lines, posterior focal lines and the circle of least confusion. For any given case the legs of the target are equally blurred.

In testing astigmatic patients there will be a difference in width of the retinal image in the two cross cylinder presentations which will be based on a change in the size of the blur circles or ellipses but will be independent of the focal line effects produced by the cross cylinder and the properly orientated target.

Now if one uses a Homokonic cross cylinder in conjunction with a rotating cross which will be set 45° to the axis of the cross cylinder one will have a stimulus situation which will not only be free of differential magnification and rotary deviation but will also be free of any focal line effects. The above analysis shows that the concept of using certain letters for the test stimuli can result in serious problems. If it were possible clinically to keep the retina coincident with the circle of least confusion of the astigmatic bundle then any test configuration would serve the purpose. However, since the state of accommodation may fluctuate from time to time it is difficult to know the amount of

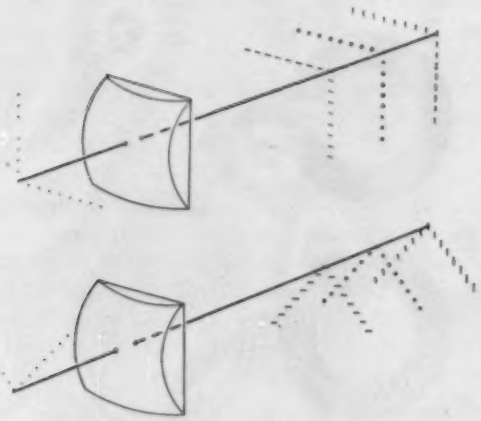

Fig. 5.

fog during this portion of the examination. It appears much simpler to use a rotating cross at all times. One should observe that the astigmatic stimulus produced by the cross cylinder is not conducive to maintaining a constant level of accommodation. Figure 5 shows a series of target configurations for the measurement of astigmatism which can be oriented 45° with respect to the axis of the cross cylinder and which eliminate the focal line problem produced by the testing cross cylinder.

Figure 6* shows the distributions of intensity on the retina of an emmetropic eye under fog produced by a cross cylinder and Landolt ring with the gap oriented in various directions with respect to the major axis of the blur ellipses. There is an obvious difference between the width of the gap in the condition where the blur ellipse is parallel to the axis of the gap and where it is perpendicular to the axis of the gap. Close inspection of the distribution of intensity of the figure where the blur ellipse is 45° to the axis of the gap will show that there will be little change in the width of the gap as the blur ellipse is orientated at either 45° or 135° with respect to the axis of the gap, but there will be a change in configuration of the retinal image. This is due to the change in location of the iso-illumination lines. This analysis shows that even such targets as Landolt rings or Verhoeff circles can be affected by the focal line problem produced by the testing cross cylinder.

Even though the present targets eliminate the major focal line problem, there is still some change in distribution of the iso-illumina-

*From Fry[3].

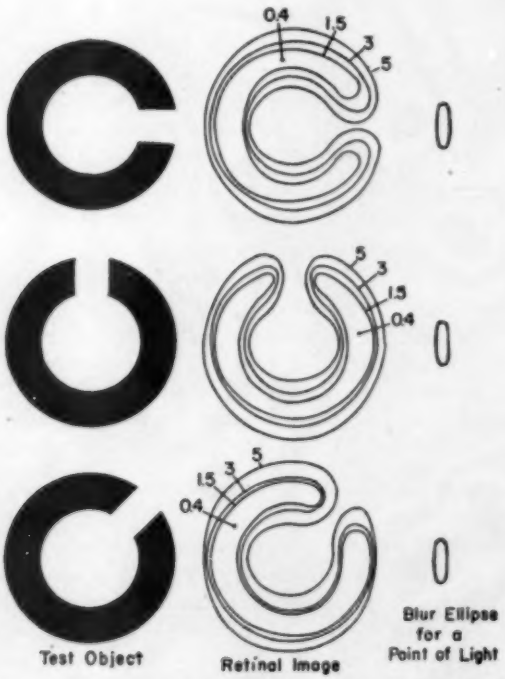

Fig. 6. Distributions of intensity on the retina produced by a Landolt ring with the gap oriented in various directions with respect to the major axis of the blur ellipse. From Fry.

tion lines at the ends of the rectangular configurations when one changes from one lens presentation to another.** Theoretically,[4] this can be minimized by employing a suitable brightness gradient which will set up a Mach ring at the end of the rectangular configuration, thus minimizing the problem.

In the clinical measurement of astigmatism with the Homokonic cross cylinder one can refine the spherical component of the retinoscopic finding by means of the bichrome test. This procedure will minimize the focal line problem, and will increase the sensitivity of the cross cylinder test. Experimental evidence shows that any fog tends to decrease the test sensitivity.[5]

**One can also minimize this problem by making the length of the rectangular configuration large with respect to its width.

After the sphere is obtained by means of the bichrome test one can maintain the balance by adding +0.25 D. sphere every time the cylindrical power is increased by —0.50 D. If refractors employed correcting cross cylinders instead of correcting plano cylinders, then one would automatically maintain the meridional balance as he changed the correcting cross cylinder from one power to another.[6]

SUMMARY

Through mathematical analysis of the optical stimulus conditions of the Jackson cross cylinder one can pin point certain phenomena which will tend to decrease the sensitivity of the test. These defects can be eliminated by using a Homokonic cross cylinder and a rotating cross test pattern which can be set up at various orientations with respect to the axis of the cross cylinder. The only remaining problem is the relationship between the power of the cross cylinder and the sensitivity of the test.[7]

From the above analysis one can proceed to design systems which will eliminate or exaggerate these various phenomena and ascertain the statistical importance of these various factors. Since the cross cylinder test is based upon simple blur circle theory, it appears obvious that differential rotary deviation, differential meridional magnification and focal line effects will all tend to decrease the sensitivity of the test.

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CHRISTMAS GREETINGS

We in optometry again salute the Christmas Season with appreciation, happiness and a spirit of reverence for the blessings our profession bestows upon millions of patients and the optometrists that serve them.

We rejoice and give thanks for the pioneer work done by those who preceded us in optometry and for their efforts which made it possible to bring our profession to the important place it occupies in the health field.

We are grateful for our own outstanding professional training and to the splendid educational centers that made this training possible. We are grateful, too, that they are doing such a fine job in continuing this work.

At this Christmas Season we rejoice in the high regard in which optometry is held and the deserved esteem given its practitioners by the public. Our hearts overflow with gladness for the loyalty and appreciation we receive from our patients.

We give thanks for our excellent sources of supply—for our manufacturers and laboratories—and the care with which they serve us, and for the freedom to select and prescribe the materials we believe are best to serve our patients—without controls or bureaucratic interference.

These and many other fine aspects of practice make us joyous at this Christmas time and enable us again to wish for all of our readers the finest of holidays.

A Merry Merry Christmas to you all.

THE EDITORIAL STAFF

STRABISMUS, ORTHOPTICS AND OPTOMETRY*

It may seem to the busy practical optometrist that an inordinate amount of time is spent in talking about strabismus and the orthoptics of strabismus. The average clinician probably sees very few patients with squint each week and many of those he does see have had lenses, orthoptics and surgery and yet they still squint. Thus he frequently says to himself, although he will seldom admit it in public, "Why all the to do about squinters since there are so few of them and no one seems to do anything significant for them anyway? Why not just send them to the surgeon who may make the squint appear smaller in degree and then we can give our attention to things we can do something about?"

It is perfectly true that there are few persons with strabismus in the general population. We are not certain what the exact number is but it is certainly less than 5 per cent—most likely it is around 3 per cent. Thus something less than one in every 20 has strabismus. The average optometrist will consider this to be a high figure.

The successful establishment of normal binocular vision in squinters is a difficult task and the per cent of squinters who obtain this goal is relatively small. The highest documented figures in the literature run around 80% cures. This high rate is unusual, the average figures reported run around 25%. Thus if we have 100 individuals, about 4 of them will have a squint and only one of these will be cured. This means that the optometrists' impressions are correct—there are only a few with this affliction who are today being successfully treated.

In part, it is this poor performance which induces the interest in

*Excerpts from the *Introductionary Remarks* by Meredith W. Morgan, O.D., Ph.D., at the Symposium on Orthoptics, annual meeting of the American Academy of Optometry, Chicago, December 8, 1957.

squint and the orthoptics of strabismus. Individuals vitally interested in their profession rise to met a challenge and certainly here is one. We all have a tendency to be interested in the unknown. Unfortunately this interest in the unknown tends to create an air of mystery which can lead to the establishment of cults. The leaders of these groups usually imply that there is some secret process which will be revealed and understood only by the true disciples.

This desire to understand strabismus and hence to improve the final results obtained in treating it is not the real challenge, however, to thinking optometrists. It is really only incidental to the bigger problem of understanding normal binocular vision and the processes which subserve it. Any general theory must not only explain the normal, but it must explain the anomalies and the abnormal as well. Any understanding of the unusual will always lead to a better understanding of the usual. A study of strabismus invariably leads to conclusions about normal binocular vision. Frequently the anomalous point up features in normal processes which are not obvious and hence studies are made on the abnormal because of the bold relief obtained for some factor.

In many instances we find that some conditions which appear anomalous differ from the normal only in degree. We might ask ourselves for example, what is the fundamental difference between the rather constant unilateral suppression demonstrated by all squinters who never have diplopia except in an instrument, the partial suppression frequently demonstrated by subjects with binocular instability and the suppression which can be demonstrated in perfectly normal subjects by using targets with crossed borders or borders in close proximity to each other? Is the amblyopia found in some persons who apparently have binocular vision different from that found in subjects with squint? Is there any fundamental difference between eccentric fixation and fixation disparity? Do individuals with anomalous correspondence have binocular vision? Is there a sharp distinction between fixation disparity and anomalous correspondence? What are the differences between the ability to fuse slightly disparate images resulting in stereoscopic vision and anomalous correspondence?

All of these questions seem easy to answer when dealing with squints of large angle but as the angle of apparent strabismus decreases, most of these questions become more and more difficult to answer. Thus these fundamental distinctions can be studied easier in squinters with fairly large angles than in those with small angles or no squint at all.

The very lack of uniform success has forced and made perfectly

obvious that some basis for prognosis must be established. The idea of making a prognosis can be carried to the whole field of optometry. The prognostic features considered in strabismus are not restricted to orthoptics applied to squinters but can be applied with slight modifications to the whole field of visual training. These are the problems of orthoptics and vision training in general and since orthoptics can be thought of as an outgrowth of refraction in the broad sense, these are problems of optometry.

MEREDITH W. MORGAN

BOOK REVIEWS

OCULAR ALLERGY. Frederick H. Theodore, M.D. and Abraham Schlossman, M.D. with Chapters by William B. Sherman, M.D. and Robert S. Coles, M.D. 420 pages of text. Published by Williams and Wilkins Company, Baltimore, Md. Price $12.00.

My remarks as a reviewer cannot be of an analytical character but must be of a discoursive nature for the reason that, while I have been associated, in past years, in biophysical research in collaboration with an expert in the field of allergy in a world-famous medical institution, I cannot claim the right to present any review other than that of cataloguing the chief contents and quoting short excerpts from the preface of the volume.

Following an excellent and brief introductory chapter on the basic principles of allergy, there is taken up the allergies of the conjunctiva (atopic, microbiallergic, dermatoconjunctivitis, vernal conjunctivities and so forth) in about 140 pages. This material is followed by about 100 pages devoted to a consideration of the allergies of the eyelids, ocular eczema, contact reactions and so forth. The allergies of the cornea, sclera, uvea, lens, retina and optic nerve complete this volume of 420 pages. The authors state in the preface that "no such book has been written in the twenty-five years since Dr. Alan C. Woods presented his excellent monograph on this subject." Assuredly this recent and up to date volume should be a welcome addition to the library of the practitioner. "The eye and its adnexa offer a unique opportunity to observe and study, both clinically and experimentally, all the fundamental allergic reactions, to an extent not possible in the body," is the statement of the authors concerning ocular allergies.

This book is a treatise on a subject which is outside of the purview and province of optometry and its field of interest and service, since the

optometrist is not concerned with the diagnosis or treatment of pathology of the eyes or any other part of the body for that matter. These procedures and practices lie wholly within the field of medical interest and attention by reason of education, training and legal licensure, at least in so far as diagnosis and treatment are concerned.

I presume to say that there is no reason why anyone interested in eyes and eyesight should not read and study such a book if he so desired. I have been one who "so desired" and have read many portions of the text with a resultant acquisition of further information of interest but "useless or valueless knowledge" in so far as applying it is concerned. I am pleased to state that I thoroughly enjoyed this splendidly printed and adequately and beautifully illustrated treatise on ocular allergies.

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HEADACHE, DIAGNOSIS AND TREATMENT. Robert Ryan. Published by the C. V. Mosby Company, St. Louis, Missouri. Second Edition. 407 pages. $6.50. 1957.

In 56 short chapters filling 407 very interesting pages, the author explores the various factors surrounding headaches. The physiological basis of head pain is discussed as completely as one may desire. The book emphasizes the physiological rather than psychological facets involved in headaches but this makes the treatise that much more valuable since too many books ignore in part or in whole the physical side of head pain. The optometrist would be interested in the final chapter on "Ophthalmologic Head Pain" but would be disappointed at the relatively minor role eye and vision headaches are given by the author. As a rather complete background on the physical side of headaches the book fills an obvious vacuum and should be required reading by the optometric under and post graduates.

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CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

TWO NEW PROMOTIONAL BOOKLETS FOR OPTOMETRY

Two new promotional monographs dealing with optometry and the work of optometrists have appeared during the year. The first, *Your Eyes and Optometry* was written and produced by the Department of Public Information, American Optometric Association. This monograph tells the story of optometry in a well written factual manner: without bombast or exaggeration: and without mud-slinging. It is a conservative booklet and a real credit to those who did the job. This monograph may be secured by members by writing A.O.A. headquarters, 4030 Chouteau Avenue, St. Louis 10.

The second monograph is entitled *Your Eyes and Your Optometrist*. This was written and produced by the Vision Research Institute, 114 North Pine Street, Wilson, North Carolina. This brochure relies upon a number of well made illustrations to get the story across. These pictures review the work of optometrists and their background of professional education. This booklet has just enough cut-lines and short type-set paragraphs to carry the reader from page to page. This monograph may be secured in quantity by optometrists through the Institute. For both monographs the cost is small.

The profession has needed this sort of thing for some time and both booklets should enjoy wide distribution.

WESLEY-JESSEN CONTRIBUTE TO STUDENT LOAN FUND AT I.C.O.

The Student Loan Fund established by Dr. Newton K. Wesley and Dr. George N. Jessen three years ago at Illinois College of Optometry was increased by two sizable contributions. The Loan Fund was beneficiary of the proceeds of the first Jessen-Wesley Practical Optometric Seminar, held at Sherman Hotel, Chicago, September 21, 1958. Miss Bette Bagnell, of the Jessen-Wesley group, presented a check in the amount of $1,501.58 to Dr. E. W. Strawn, president of Illinois College of Optometry, at the close of the optometric seminar. Miss Bagnell originated the idea of the seminar and of making the Student Loan Fund at I.C.O., the beneficiary of the proceeds. In addition to the check received from Miss Bagnell, Dr. Strawn was also presented with a check in the amount of $2,000.00 for the Wesley-Jessen Student Loan Fund, by Dr. George N. Jessen.

Dr. Strawn, upon receiving the checks, commended the Wesley-Jessen organization for these generous gifts, and also expressed the appreciation of the College for this continued interest shown for the College and the welfare of students. He also explained the functioning and purposes of the Fund, stating that it was used by students, interest free, on an indefinite loan basis, and that its purpose was to defray emergency expenses that students are faced with from time to time during their three years at the college.

MODERN FINANCING IN VISION CARE

The only important factor that has been holding back practice development in many optometrists offices has been the lack of an adequate plan of handling patient credit. Today budget financing must become a part of every optometric practice. All patients whose present credit standing is good, should have the opportunity of budget payments for professional optometric services and materials.

Recently, the Optical Manufacturers Association arranged for the mailing of a special booklet *The Key to Modern Financing in Vision Care* to a large number of optometrists. This booklet reviews the program of the Charge Account Bankers Association for financing better vision. The plan outlined in this booklet has been tested and found satisfactory to both patients and doctors.

In every community optometrists should contact their local bankers and get this program into operation at once. Local optometric societies should make the contacts and then distribute the forms and literature to all members, who in turn will pass the information on to patients. When this program is widely established it will close the gap which now exists in developing a well rounded service for more and more patients, and make the approved idea of prescribing for multiple visual needs, a reality.

AMERICAN OPTOMETRIC FOUNDATION GRANT TO INDIANA UNIVERSITY

The American Optometric Foundation has presented a $3,500 gift to Indiana University for filming a special educational series on vision and optometric science. The series, involving five half-hour shows, will be produced under the title, *Let's See*. These programs were inaugurated in the summer of 1955 and additional productions were filmed each of two succeeding years. Plans for 1958 filming and announcement of the foundation's gift were announced by Dr. Henry W. Hofstetter, director of the I. U. division of optometry. The new programs will be produced by the department of radio and television, in cooperation with the division of optometry. Dr. Gordon G. Heath, assistant professor of optometry, will narrate the films for the second

consecutive summer, and Robert Petronoff, radio and TV departmental producer and lecturer, will serve as director of the series. Four sets of the new *Let's See* series will be made available for distribution in Indiana and other states upon request.

Dr. Neal J. Bailey, a member of the faculty of Indiana University Division of Optometry since 1954, has resigned his position as associate professor of optometry to join Dr. Bernard S. Abrams of Columbus, Ohio, in the private practice of optometry. While at Indiana University, Dr. Bailey was in charge of the contact lens clinic and courses in ophthalmic optics. In his new association he will devote most of his time to contact lens work, including teaching of contact lens techniques as an adjunct to the office practice.

Dr. Charles R. Shick, a 1958 graduate of Indiana University Division of Optometry, has been appointed instructor in optometry at Indiana University for 1958-59. Dr. Shick has been placed in charge of the courses in mechanical and ophthalmic optics and the contact lens clinic.

NEW INSTRUMENTS

Here are some announcements that we have received recently. These items are new and if you wish to have additional information on these, write direct to the manufacturer at the address given.

The Keystone View Company, Meadville, Pennsylvania, are offering their new Fusion Games service to optometrists. This home training kit includes 20 large pictures with stereoscopic color separation, easel, 3-D viewers and instruction for home visual training to improve stereopsis. It is claimed that children find this fun to use—thus making a game out of home training periods.

The new Vision Tester developed by Titmus Optical Company, Petersburg, Virginia, is now in production. This instrument measures visual skills and identifies patients requiring additional refractive care. It is designed for use by industrial and commercial plants, schools, driver licensing departments, the Military and others. The Titmus announcement states that the new tester is a compact, lightweight (17 pounds) precision instrument of entirely new design, and that it measures important functions of vision with new simplicity and speed.

Any number of test slides, up to 12, can be mounted on the single drum for either "far" or "near" visual performance testing. The test slides can be positioned instantly by rotating the drum electrically with the press of a button, or manually by a twist of a knob. The test slides can be interchanged, thereby permitting special tests for specific purposes. The slides are protected by glass for permanence and ease of cleaning.

The T/O Vision Tester will be sold and serviced by independent optical distributors throughout the country. It is available only under the direction of a licensed practitioner.

The Roberts' Instrument Company, Inc., Moberly, Missouri, announces its new Model G-II Multiple Target Screener. This screening instrument with a flashing screen and wand adds a new technique to visual field testing. A 2/330 moveable illuminated target is synchronized with the fixation target and blind spot marker. Another new feature insures accuracy of alignment but eliminates all fixation targets at the moment of testing. G-II combines the advantages of the tachistoscope with the standard tangent screen. The instrument is available through all optical laboratories.

The Allied Ophthalmic Products Co., 4814 West 83rd Street, Oak Lawn, Illinois, makers of the Strabismometer, announces the release of its new Muscle Balance Survey Tester. This new instrument is unique in that the subject being tested does not have to describe what he sees to the examiner, thereby eliminating inaccurate responses by children, which is a cause of overreferrals for visual examinations by school nurses. The Survey Tester functions to check the horizontal and vertical muscle balances simultaneously. Testing time has averaged 15 seconds per child. This new instrument enables those schools which presently test only visual acuity to inclue eye muscle screening with little additional effort.

The Burton Manufacturing Company, 2520 Colorado Avenue, Santa Monica, California, are now introducing a new Harrington-Flocks Multiple Pattern Visual Field Screener to be used in screening patients for glaucoma. The new instrument is an improved model of an original screener brought out about three years ago. Dr. William A. Mendelsohn is president of the Burton Company. He will be remembered by many optometrists as the maker of the myoculator which was one of the early orthoptic instruments.

NEWS FROM SUPPLIERS

Minneapolis, Minn. Benson Optical Company announces a new all American athletic frame with new safety and comfort design features. These new all American athletic glasses have been designed to provide utmost eye protection without interferring with performance—even during rough play. Specially contoured lenses, designed to properly fit the face, provide full-range vision without distortion. Frame ends have been rounded and streamlined to prevent injury to opposing players. As an added margin of protection, drop-ball tested safety glass or plastic lenses—offering high impact resistance—are suggested

for use in each pair. A special "cushion fit" nose bridge—molded from shock absorbent rubber—offers the wearer optimum protection and comfort. Extra deep eye-wire channels eliminate the chances of lenses popping out—even in the event of a collision or hard fall. The "Glass-Gard" headband is adjustable and holds the frame firmly in place. These frames are available in 44 and 47 mm. eye sizes and bridge sizes corresponding to 20 and 23 mm. regular saddle bridge. Temple lengths range from 6" through 7". The frames come complete with an imprinted case identifying each pair as genuine all American athletic glasses.

Rochester, N. Y. The Bausch & Lomb Optical Company has acquired from House of Vision, Inc., Chicago, all capital stock of Pioneer Scientific Corporation of Great Neck, Long Island, New York, manufacturer of Enduron plastic ophthalmic lenses. This announcement was made by Carl S. Hallauer, B&L president, and Bernard Spero, president of House of Vision, following a meeting of B&L board of directors. Pioneer Scientific Corporation, which was established in 1943, will be a wholly-owned subsidiary of Bausch & Lomb.

The acquisition of the Long Island company signifies the entrance by Bausch & Lomb into the plastic lens field. The Pioneer operations are devoted principally to the production of plastic spectacle lenses. In addition to a complete line of regular prescription ophthalmic plastic lenses, the company manufactures lenses for conventional type safety glasses and face plates for welders' goggles. It also produces plastic tinted lenses for sun glasses and plano lenses used in gas masks.

Southbridge, Mass. A major development in the manufacture of cataract lenses has been announced by American Optical Company, with the marketing of its new Aolite Aspheric Cataract Lens. Although the advantages of aspherical surfaces for cataract lenses have been known for many years, it has heretofore been impractical to produce such surfaces since they cannot be fabricated by the usual production methods. With the development of the synthetic material Aolite, it is now possible to cast both single vision and bifocal lenses with aspherical surfaces. The result is a lightweight lens which is corrected for marginal astigmatism, marginal power error, and to some extent for distortion. This has enabled the spot size to be increased to 40 mm. allowing an increase in the field of vision up to 33% over old types of cataract lenses. Being a lenticulated form with a 40 mm. round spot, the Aolite Aspheric Cataract Lenses can be edged to fit virtually any fashionable frame without increasing the lens thickness. Range offered is +8.00 D. through +16.00 D. sphere, out to —4.00 cylinder; 2.50 and 3.00 D. adds only.

In addition, in order to meet the demand for a distinctive line of cut-off bifocals, American Optical has placed on the market its new Tillyer Sovereign line made of regular ophthalmic glass. Called the only complete line of curved-top-segment bifocal lenses available, the Sovereign comes in 20, 22 and 25 mm. segments. According to AO, the curved top of the Sovereign follows the natural sweep of the eye, provides a more useful field of view and is extremely effective in "scattering" reflections. In addition, the shouldered edges and inner face of the 25 mm. segment are coated with 24 K. Gold to further control reflections.

New York, N. Y. The Better Vision Institute says, "In a country that's growing, needing, wanting, buying, when are we going to stop talking to ourselves? And when are we going to stop cutting one anothers throats by reslicing the same small economic pie? Wouldn't it be smarter, saner to start building a bigger, better pie so that all slices would be more rewarding? Wouldn't it be wiser to "slug it out" with the consumer, not each other, and step up his want-appetite? For in the last analysis the consumer is king. He controls the purse-strings that can make our pie fatter and bigger. It's his needs and wants for functional eye-care and for fashionable and correct eyewear, more often, that can "make our take" bigger in the months and years ahead. Shall we continue to double-talk and double-deal, or shall we go to town with a sound, solid, market-building, consumer-educational program?"

Des Moines, Iowa. The addition of 55 m/m square semi-finished cylinders to the line of Therminon absorptive lenses has been announced by company officials. Ralph Moran, vice-president, said the new square cylinders are ready now for immediate delivery. They are radii corrected, (corrected curve). There is no price change, Moran said. He pointed out that the new square cylinders can be used to produce a 60 m/m diagonal. Therminon Lens Corp., 63rd and University Ave., Des Moines, Iowa, is the exclusive manufacturer of Therminon absorptive lenses.

St. Paul, Minn. The Maxson Optical Company has announced distribution of their new "Klips-on" sun glasses—a totally different type of clip-on now being sold only through optical laboratories. These new protection glasses feature an exclusive, patented adjustable spring clip which gives the wearer instant "clip-on clip-off" action. The lenses are made of optically correct Enduron that offer color uniformity and eliminate the possibility of accidental breakage in addition to offering high surface scratch resistance. The new clip enables them to fit

over nearly all frames. The entire product weighs less than ½ oz. and are light as a feather for greater wearing comfort.

LOS ANGELES COLLEGE FACULTY SEMINARS

The faculty of Los Angles College of Optometry is holding a series of bimonthly seminars to which all optometrists are invited . The next of these will be held on February 2, 1959. The speaker will be Dr. Margaret Dowaliby. Her subject will be *Multifocal Lenses and Their Application.* On April 6, 1959, Dr. Harry Jankiewicz will speak on *Practical Neurology for the Optometrist* and on June 1, 1959, Dr. Max Schapero will speak on *Convergence Accommodation and Its Application in Case Analysis.* The formal presentations will be limited to 50 minutes to be followed by general discussion and questions. The meetings start at 7:30 p. m. and will be held in Room 234 of the College Building.

ROSENBLOOM ADDRESSES ILLINOIS FEDERATION FOR THE BLIND

Dr. Alfred Rosenbloom, Jr., dean, Illinois College of Optometry, addressed 200 delegates to the annual convention of the Illinois Federation of the Blind at the banquet of this organization, Friday, October 24 at the Dunlap Hotel, Jacksonville, Illinois. His subject was *Visual Rehabilitation of the Partially Blind—An Analysis of Heartening Trends.* Dr. Rosenbloom reviewed recent advances in optometric techniques for improving the visual efficiency of partially blind individuals. As illustrative of recent advances he cited case histories and described researches in subnormal vision being conducted at the Chicago Lighthouse for the Blind. The Illinois Federation of the Blind, a member of the National Federation of the Blind, is an organization of blind people whose principal objective is the furtherance and improvement of rehabilitative programs for blind people. The convention host was the Alumni Association of the Illinois Braille and Sight Saving School in Jacksonville, Illinois. On the next day Dr. Rosenbloom spoke at a seminar on rehabilitation of partially blind children and adults, sponsored by the Illinois Valley Optometric Society. His discussion—*Meeting the Educational Needs of the Blind and Partially Sighted* was heard by an enthusiastic inter-professional audience of optometrists, educators, and school nurses. The meeting was held at the Pere Marquette Hotel, Peoria, Illinois. Chairmen of the meeting were, Dr. Jerome B. Conlogue, president of the society, Dr. John M. DeMoure, and Dr. J. A. Potter, all of Peoria, Illinois.

PURVIS URGES COOPERATION

At the American Optometric Association Public Relations Roundtable in St. Louis, September 27, 1958, the president, Dr. Hoyt S.

Purvis of the A.O.A., urged members to seek harmony with all individuals and groups. During his talk he stressed:

"That A.O.A. has no desire to extend optometry into the medical field.

"That the legislative attempts to extend optometry into the medical field have been by individuals and local groups not speaking for A.O.A. and in fact opposed by A.O.A. in such activities.

"That danger to the public and all professions in the vision care field can come from irresponsible charges and public controversy.

"That optometry seeks friendship and cooperation with medicine in general and the ophthalmologist in particular.

"That optometry recognizes that medical refraction will continue; optometry has no plan to oppose it, but that the ophthalmologist's major field—treatment of pathology—can be best cultivated by working with optometrists who are a chief source of referral."

HOFSTETTER HEADS STATE ASSOCIATION EDITORS ASSOCIATION

Dr. Henry W. Hofstetter, director, Indiana University Division of Optometry, was appointed president-elect of the Association of State Optometry Journal Editors to fill the unexpired term of the late Dr. Seymour Schneider. Dr. Hofstetter is the new editor of the INDIANA JOURNAL OF OPTOMETRY, a publication which will make its first appearance in January, 1959, as a successor to the previously discontinued JOURNAL OF THE INDIANA OPTOMETRIC ASSOCIATION. He has previously served on the editorial boards of the INDIANA OPTOMETRIST, the CALIFORNIA OPTOMETRIST, and the O-EYE-O, and is presently on the Editorial Council of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

CONTACT LENS MEETINGS

The Contact Lens Association for Optometry, Chicago, announces the following tentative conference meeting schedule for 1959:

Detroit, February 1-2. First Peninsular Optometric Contact Lens Conference.

Seattle, February 22-23. Second Northwestern Optometric Contact Lens Conference.

St. Louis, March 29-30. Second Mid-Continent Optometric Contact Lens Conference.

New Orleans, April 12-13. First Mid-Southern Optometric Contact Lens Conference.

Boston, May 3-4. First New England Optometric Contact Lens Conference.

Atlanta, May 24-25. Second Southeastern Optometric Contact Lens Conference.

Los Angeles, June 7-8. First Far Western Optometric Contact Lens Conference.

Denver, June 14-15. Second Rocky Mountain Optometric Contact Lens Conference.

Pittsburgh, September 6-7. Third Eastern Optometric Contact Lens Conference.

Minneapolis, October 11-12. Second North-Central Optometric Contact Lens Conference.

For additional information on any of these contact lens meetings write the Contact Lens Association for Optometry, 37 S. Wabash, 12th floor, Chicago 3, Illinois.

I.C.O. PRESS FORMED

The Illinois College of Optometry announces the formation within the College structure of an editorial and publications committee which will function as, "I.C.O. PRESS." This committee will supervise and edit publications coming under the banner of Illinois College of Optometry.

The first publication to be undertaken by this new group will be the second edition of Ralph Barstow's book, *How to Succeed in Optometry*. All rights to this book have been acquired by I.C.O. and it is believed that the new edition will be out on or about January 1, 1959.

NEWS BRIEFS

Dr. Frederick W. Brock, Staten Island, New York City, received the honorary degree of doctor of science at Wagner College, Staten Island on October 19. Dr. Brock, a renowned optometrist, was cited for both his professional and civic contributions. He pioneered in the orthoptic treatment of squint and developed techniques now widely used. He is a former faculty member of the School of Optometry, Columbia University, and is now an associate in visual training at the Optometric Center of New York. . . . A year ago, Bausch & Lomb Optical Company introduced an amazing little book entitled *The Story of Wilbur T. Mize*. In spritely verse and entertaining cartoons, it told the story of multiple vision needs and how they can best be satisfied. The original edition of 5,000 copies is now almost exhausted, and B&L find that lower costs on a reprint will justify a reduction in price from $2.50 to $1.75. On quantities of 10 or more, there is a discount of 10%. At these new prices, it will be more practical than ever before to use the book as a means of educating the public on the subject of multiple prescriptions. . . . Dr. Raymond R. Roy, Portland, Oregon, will be the featured speaker at the annual mid-winter convention of the Colorado Optometric Association in Denver, Albany Hotel, December 6-8. His subject will be Headaches of Ocular Origin.

Dr. A. M. Skeffington, St. Louis, educational director of the Optometric Extension Program was featured as the 10th leader in education in the October, 1958, issue of the magazine EDUCATION. His photograph appeared on the front cover and a three page review of his work in optometry also appeared in the issue. This excellent tribute was awarded to Dr. Skeffington as the editors felt that he was the person who had established the "importance of vision," in the lives of school children. . . . This year, in connection with the 40th anniversary of their Glass Plant, Bausch & Lomb Optical Co., Rochester, N. Y., commissioned Ralph Avery, nationally known artist, to make a full color painting of the modern, automated glass production process. The painting, which shows the famous B&L "Continuous Flow" furnaces, is now available to optometrists for use in their dispensing or reception rooms. This illustration is a unique as well as an artistic way in which to feature a side of the optical industry which is unknown to the general public. The painting, handsomely framed in bleached ash 26¼"x21¾" may be ordered at cost: $2.75 each. Reproduction has shellacked surface, making a glass shield unnecessary, although the frame can easily accommodate one if desired. The same picture, size 19x24 (without frame and in mailing tube), is available without cost.

Howard Quankenbush, vice-president of White-Haines Optical Company, Columbus, Ohio, was awarded the 14-millionth Browline Frame made by Shuron Optical Company of Geneva and Rochester, New York. To mark the occasion, the frame was encased in a block of clear plastic for permanent preservation and a suitably engraved plate was attached to it. . . . The American Optometric Association had two booths at the 86th annual meeting of the American Public Health Association, St. Louis, October 27-31. The exhibits covered (1) vision aids for the aged (2) screening and care for school children and (3) screening and care for motor car drivers. . . . Textron, Inc., already owner of 16 large unrelated and diversified companies, has purchased the Shuron Optical Company from its former owners, the Philadelphia and Reading Corp. The following officers of Shuron will continue in their present capacities: Donald F. Southgate, president; Roy Marks, executive vice-president. No changes in policy, personnel or business procedures are contemplated. . . . The newly elected officers of the American Board of Opticianry are, president, Howard Quackenbush, White-Haines Optical Company, Columbus; vice-president, Albert L. Anderson, Precision-Cosmet Company, Minneapolis, and secretary-treasurer, Dr. Charles Sheard, Rochester, Minnesota.

The Scientific Publishing Company, Baltimore, announces that Dr. Israel Dvorine has been informed that the Armed Services Medical Materiel Coordination Committee has designated the Dvorine Pseudo-Isochromatic Plates to be of acceptable quality, meeting the requirements of the military services. . . . In the article entitled *"The Relationship Between Intelligence and the Refractive State in a Selected High School Sample"* by Melvine C. Nadell and Monroe J. Hirsch, Vol. 35, June, 1958, page 323 of this publication, Dr. Joy Goodsell is referred to as "she." This should be "he." . . . The American Optical Company has received a contract from the Department of the Navy to develop a part of the second generation Sidewinder missile. . . . The Precision-Cosmet Company, Minneapolis, has been licensed to manufacture and sell its Nonscleral contact lenses under litigated patent No. 2510438. This U. S. Patent covers the original concept of corneal-type lenses, and has twice been held valid in court actions. . . . The California Vision Services, which is an affiliate of the California Optometric Association, announces that it has renewed contracts with the Hod Carriers Union and the Gardeners, Florists and Nurserymen's Union in the San Francisco-Oakland bay area for fully pre-paid vision care for their members. In these new contracts, dependent children, age 6-19, are included for the first time.

UNIVERSITY OF HOUSTON REVISES OPTOMETRY COURSE

Approval of a revised course of study in optometry at University of Houston has been announced by Dr. Philip G. Hoffman, vice president and dean of faculties. This revision will accomplish several important objectives, these being more complete coordination of clinical practice with theory, and greater flexibility in course sequences. Under the revised program, students will commence their clinical work immediately upon entering the professional courses. It is thought that after having had practical experience working with patients under supervision of the clinic staff, students will be better able to comprehend the concepts of optometric theory. By being assigned to the clinic early, the student will receive the maximum possible amount of clinical experience during his time in the College of Optometry and his progress can be measured to an extent by observing his success with patients, as well as by his ability to apply theoretical knowledge to the problems of his patients.

Greater flexibility in the new program is accomplished by including additional electives, so that in the curriculum there are 36 semester hours of electives. Among other advantages, a student transferring to the University of Houston may make up course deficiencies easier than has previously been the case. One-third of the electives are included in

pre-optometry, one-third in the first two years of the professional program, and one-third in the last year. Certain electives may be used to facilitate the program of study for a student changing to optometry from another major field. Also, under certain conditions a student may enter the professional program in the Spring semester, whereas heretofore it was necessary to wait until the Fall semester.

The University of Houston will continue its five year program whereby the Certificate in Optometry is awarded for three years of professional study preceded by the regular two years of pre-optometry. The Certificate meets standard educational requirements for the practice of optometry and satisfies State Board Examination requirements. Students who do not already have a bachelor's degree earn one in the College of Arts and Sciences concomitantly with their optometric studies. The Doctor of Optometry degree is awarded after completion of an optional additional year of advanced work beyond the five year program.

The College of Optometry, University of Houston, will present a post-graduate course in contact lens fitting to start on January 10, 1959. The course will be under the direction of Dr. Herman H. Gerdes, Jr., of Waco. The outline of the course called, "Contact Lens Modifications," is available by writing the College. Tuition for the course is $35 plus $20 for materials. Enrollment is limited and registration must be made far enough in advance to order the necessary materials, including contact lenses with the students' correction. In requesting registration, send spectacle prescription and keratometer reading for both eyes.

THIRD CONTACT LENS COURSE AT PENN STATE

The third seven-day post graduate course in the filling of contact lenses for this school year will be given on the campus of the Pennsylvania State College of Optometry, March 25 through April 1, 1959. The attendance at these special courses is limited to 12 optometrists. Six members of the faculty give the work at the clinics where much of it will be done on patients. Optometrists interested in attending this post graduate course may obtain further information and application form by writing the Dean, Pennsylvania State College of Optometry, 6100 N. 12th Street, Philadelphia 41.

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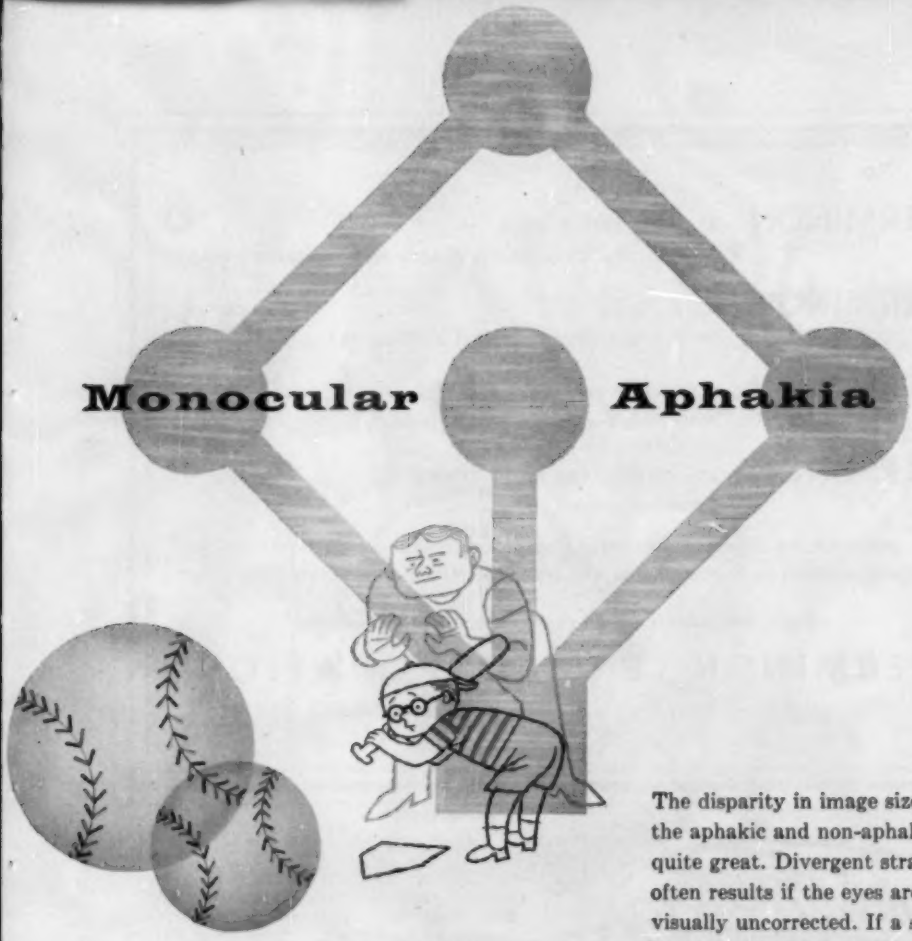

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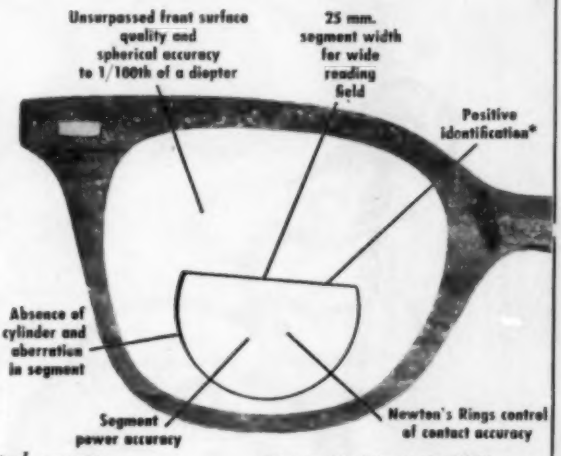
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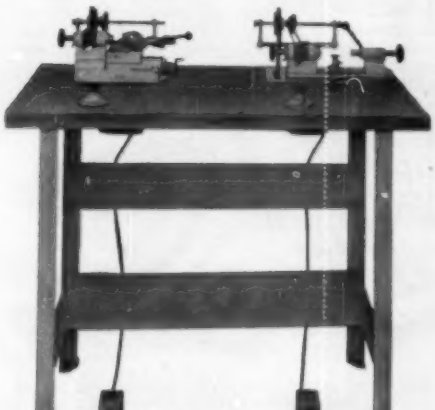

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